SEQUENCE LISTING

<110>   THE GOVERNMENT OF THE UNITED STATES OF AMERICA AS
        REPRESENTED BY THE SECRETARY OF THE DEPARTMENT OF HEALTH AND
        HUMAN SERVICES, CENTERS FOR DISEASE CONTROL AND PREVENTION
        Rota, Paul A.
        Anderson, Larry J.
        Bellini, William J.
        Comer, James A.
        Erdman, Dean D.
        Goldsmith, Cynthia S.
        Humphrey, Charles D.
        Ksiazek, Thomas G.
        Monroe, Stephan S.
        Oberste, M. Steven
        Pallansch, Mark A.
        Rollin, Pierre E.
        Shieh, Wun-Ju
        Zaki, Sherif R.

<120>   NOVEL CORONAVIRUS ISOLATED FROM HUMANS

<130>   6395-67788

<150>   US 60/465,927
<151>   2003-04-25

<160>   38

<170>   PatentIn version 3.2
<210>   1
<211>   29727
<212>   DNA
<213>   Coronavirus

<220>
<221>   misc_feature
<222>   (265)..(13398)
<223>   ORF 1a

<220>
<221>   misc_feature
<222>   (13398)..(21482)
<223>   ORF 1b

<220>
<221>   misc_feature
<222>   (21492)..(25256)
<223>   ORF S

<220>
<221>   misc_feature
<222>   (25268)..(26089)
<223>   ORF X1

<220>

```
<221>  misc_feature
<222>  (25689)..(26150)
<223>  ORF X2


<220>
<221>  misc_feature
<222>  (26117)..(26344)
<223>  ORF E


<220>
<221>  misc_feature
<222>  (26398)..(27060)
<223>  ORF M


<220>
<221>  misc_feature
<222>  (27074)..(27262)
<223>  ORF X3


<220>
<221>  misc_feature
<222>  (27273)..(27638)
<223>  ORF X4


<220>
<221>  misc_feature
<222>  (27864)..(28115)
<223>  ORF X5


<220>
<221>  misc_feature
<222>  (28120)..(29385)
<223>  ORF N


<400>  1
ttattaggtt tttacctacc caggaaaagc caaccaacct cgatctcttg tagatctgtt        60

ctctaaacga actttaaaat ctgtgtagct gtcgctcggc tgcatgccta gtgcacctac       120

gcagtataaa caataataaa ttttactgtc gttgacaaga aacgagtaac tcgtccctct       180

tctgcagact gcttacggtt tcgtccgtgt tgcagtcgat catcagcata cctaggtttc       240

gtccgggtgt gaccgaaagg taagatggag agccttgttc ttggtgtcaa cgagaaaaca       300

cacgtccaac tcagtttgcc tgtccttcag gttagagacg tgctagtgcg tggcttcggg       360

gactctgtgg aagaggccct atcggaggca cgtgaacacc tcaaaaatgg cacttgtggt       420

ctagtagagc tggaaaaagg cgtactgccc cagcttgaac agccctatgt gttcattaaa       480

cgttctgatg ccttaagcac caatcacggc cacaaggtcg ttgagctggt tgcagaaatg       540

gacggcattc agtacggtcg tagcggtata acactgggag tactcgtgcc acatgtgggc       600

gaaaccccaa ttgcataccg caatgttctt cttcgtaaga acggtaataa gggagccggt       660
```

```
ggtcatagct atggcatcga tctaaagtct tatgacttag gtgacgagct tggcactgat    720

cccattgaag attatgaaca aaactggaac actaagcatg gcagtggtgc actccgtgaa    780

ctcactcgtg agctcaatgg aggtgcagtc actcgctatg tcgacaacaa tttctgtggc    840

ccagatgggt accctcttga ttgcatcaaa gattttctcg cacgcgcggg caagtcaatg    900

tgcactcttt ccgaacaact tgattacatc gagtcgaaga gaggtgtcta ctgctgccgt    960
gaccatgagc atgaaattgc ctggttcact gagcgctctg ataagagcta cgagcaccag   1020

acacccttcg aaattaagag tgccaagaaa tttgacactt tcaaagggga atgcccaaag   1080

tttgtgtttc ctcttaactc aaaagtcaaa gtcattcaac cacgtgttga aaagaaaag    1140

actgagggtt tcatggggcg tatacgctct gtgtaccctg ttgcatctcc acaggagtgt   1200

aacaatatgc acttgtctac cttgatgaaa tgtaatcatt gcgatgaagt ttcatggcag   1260

acgtgcgact ttctgaaagc cacttgtgaa cattgtggca ctgaaaattt agttattgaa   1320

ggacctacta catgtgggta cctacctact aatgctgtag tgaaaatgcc atgtcctgcc   1380

tgtcaagacc cagagattgg acctgagcat agtgttgcag attatcacaa ccactcaaac   1440

attgaaactc gactccgcaa gggaggtagg actagatgtt ttggaggctg tgtgtttgcc   1500

tatgttggct gctataataa gcgtgcctac tgggttcctc gtgctagtgc tgatattggc   1560

tcaggccata ctggcattac tggtgacaat gtggagacct tgaatgagga tctccttgag   1620

atactgagtc gtgaacgtgt taacattaac attgttggcg attttcattt gaatgaagag   1680

gttgccatca ttttggcatc tttctctgct tctacaagtg cctttattga cactataaag   1740

agtcttgatt acaagtcttt caaaaccatt gttgagtcct gcggtaacta taaagttacc   1800

aagggaaagc ccgtaaaagg tgcttggaac attggacaac agagatcagt tttaacacca   1860

ctgtgtggtt ttccctcaca ggctgctggt gttatcagat caatttttgc gcgcacactt   1920

gatgcagcaa accactcaat tcctgatttg caaagagcag ctgtcaccat acttgatggt   1980

atttctgaac agtcattacg tcttgtcgac gccatggttt atacttcaga cctgctcacc   2040

aacagtgtca ttattatggc atatgtaact ggtggtcttg tacaacagac ttctcagtgg   2100

ttgtctaatc ttttgggcac tactgttgaa aaactcaggc ctatctttga atggattgag   2160

gcgaaactta gtgcaggagt tgaatttctc aaggatgctt gggagattct caaatttctc   2220

attacaggtg tttttgacat cgtcaagggt caaatacagg ttgcttcaga taacatcaag   2280

gattgtgtaa aatgcttcat tgatgttgtt aacaaggcac tcgaaatgtg cattgatcaa   2340

gtcactatcg ctggcgcaaa gttgcgatca ctcaacttag gtgaagtctt catcgctcaa   2400
```

3

```
agcaagggac tttaccgtca gtgtatacgt ggcaaggagc agctgcaact actcatgcct    2460

cttaaggcac caaaagaagt aacctttctt gaaggtgatt cacatgacac agtacttacc    2520

tctgaggagg ttgttctcaa gaacggtgaa ctcgaagcac tcgagacgcc cgttgatagc    2580

ttcacaaatg gagctatcgt tggcacacca gtctgtgtaa atggcctcat gctcttagag    2640

attaaggaca aagaacaata ctgcgcattg tctcctggtt tactggctac aaacaatgtc    2700

tttcgcttaa aagggggtgc accaattaaa ggtgtaacct ttggagaaga tactgtttgg    2760

gaagttcaag gttacaagaa tgtgagaatc acatttgagc ttgatgaacg tgttgacaaa    2820

gtgcttaatg aaaagtgctc tgtctacact gttgaatccg gtaccgaagt tactgagttt    2880

gcatgtgttg tagcagaggc tgttgtgaag actttacaac cagtttctga tctccttacc    2940

aacatgggta ttgatcttga tgagtggagt gtagctacat tctacttatt tgatgatgct    3000

ggtgaagaaa acttttcatc acgtatgtat tgttcctttt accctccaga tgaggaagaa    3060

gaggacgatg cagagtgtga ggaagaagaa attgatgaaa cctgtgaaca tgagtacggt    3120

acagaggatg attatcaagg tctccctctg gaatttggtg cctcagctga aacagttcga    3180

gttgaggaag aagaagagga agactggctg gatgatacta ctgagcaatc agagattgag    3240

ccagaaccag aacctacacc tgaagaacca gttaatcagt ttactggtta tttaaaactt    3300

actgacaatg ttgccattaa atgtgttgac atcgttaagg aggcacaaag tgctaatcct    3360

atggtgattg taaatgctgc taacatacac ctgaaacatg gtggtggtgt agcaggtgca    3420

ctcaacaagg caaccaatgg tgccatgcaa aaggagagtg atgattacat taagctaaat    3480

ggccctctta cagtaggagg gtcttgtttg ctttctggac ataatcttgc taagaagtgt    3540

ctgcatgttg ttggacctaa cctaaatgca ggtgaggaca tccagcttct taaggcagca    3600

tatgaaaatt tcaattcaca ggacatctta cttgcaccat gttgtcagc aggcatattt    3660

ggtgctaaac cacttcagtc tttacaagtg tgcgtgcaga cggttcgtac acaggtttat    3720

attgcagtca atgacaaagc tctttatgag caggttgtca tggattatct tgataacctg    3780

aagcctagag tggaagcacc taaacaagag gagccaccaa acacagaaga ttccaaaact    3840

gaggagaaat ctgtcgtaca gaagcctgtc gatgtgaagc aaaaattaa ggcctgcatt    3900

gatgaggtta ccacaacact ggaagaaact aagtttctta ccaataagtt actcttgttt    3960

gctgatatca atggtaagct ttaccatgat tctcagaaca tgcttagagg tgaagatatg    4020

tctttccttg agaaggatgc accttacatg gtaggtgatg ttatcactag tggtgatatc    4080

acttgtgttg taatacccctc caaaaaggct ggtggcacta ctgagatgct ctcaagagct    4140
```
                                   4

```
ttgaagaaag tgccagttga tgagtatata accacgtacc ctggacaagg atgtgctggt    4200

tatacacttg aggaagctaa gactgctctt aagaaatgca aatctgcatt ttatgtacta    4260

ccttcagaag cacctaatgc taaggaagag attctaggaa ctgtatcctg gaatttgaga    4320

gaaatgcttg ctcatgctga agagacaaga aaattaatgc ctatatgcat ggatgttaga    4380

gccataatgg caaccatcca acgtaagtat aaaggaatta aaattcaaga gggcatcgtt    4440

gactatggtg tccgattctt cttttatact agtaaagagc ctgtagcttc tattattacg    4500

aagctgaact ctctaaatga gccgcttgtc acaatgccaa ttggttatgt gacacatggt    4560

tttaatcttg aagaggctgc gcgctgtatg cgttctctta aagctcctgc cgtagtgtca    4620

gtatcatcac cagatgctgt tactacatat aatggatacc tcacttcgtc atcaaagaca    4680

tctgaggagc actttgtaga aacagtttct ttggctggct cttacagaga ttggtcctat    4740

tcaggacagc gtacagagtt aggtgttgaa tttcttaagc gtggtgacaa aattgtgtac    4800
cacactctgg agagccccgt cgagtttcat cttgacggtg aggttctttc acttgacaaa    4860

ctaaagagtc tcttatccct gcgggaggtt aagactataa aagtgttcac aactgtggac    4920

aacactaatc tccacacaca gcttgtggat atgtctatga catatggaca gcagtttggt    4980

ccaacatact tggatggtgc tgatgttaca aaaattaaac ctcatgtaaa tcatgagggt    5040

aagactttct ttgtactacc tagtgatgac acactacgta gtgaagcttt cgagtactac    5100

catactcttg atgagagttt tcttggtagg tacatgtctg ctttaaacca cacaaagaaa    5160

tggaaatttc ctcaagttgg tggtttaact tcaattaaat gggctgataa caattgttat    5220

ttgtctagtg ttttattagc acttcaacag cttgaagtca aattcaatgc accagcactt    5280

caagaggctt attatagagc ccgtgctggt gatgctgcta acttttgtgc actcatactc    5340

gcttacagta ataaaactgt tggcgagctt ggtgatgtca gagaaactat gacccatctt    5400

ctacagcatg ctaatttgga atctgcaaag cgagttctta atgtggtgtg taaacattgt    5460

ggtcagaaaa ctactacctt aacgggtgta gaagctgtga tgtatatggg tactctatct    5520

tatgataatc ttaagacagg tgtttccatt ccatgtgtgt gtggtcgtga tgctacacaa    5580

tatctagtac aacaagagtc ttcttttgtt atgatgtctg caccacctgc tgagtataaa    5640

ttacagcaag gtacattctt atgtgcgaat gagtacactg gtaactatca gtgtggtcat    5700

tacactcata taactgctaa ggagaccctc tatcgtattg acggagctca ccttacaaag    5760

atgtcagagt acaaaggacc agtgactgat gttttctaca aggaaacatc ttacactaca    5820

accatcaagc ctgtgtcgta taaactcgat ggagttactt acacagagat tgaaccaaaa    5880
```

5

```
ttggatgggt attataaaaa ggataatgct tactatacag agcagcctat agaccttgta    5940

ccaactcaac cattaccaaa tgcgagtttt gataatttca aactcacatg ttctaacaca    6000

aaatttgctg atgatttaaa tcaaatgaca ggcttcacaa agccagcttc acgagagcta    6060

tctgtcacat tcttcccaga cttgaatggc gatgtagtgg ctattgacta tagacactat    6120

tcagcgagtt tcaagaaagg tgctaaatta ctgcataagc caattgtttg gcacattaac    6180

caggctacaa ccaagacaac gttcaaacca aacacttggt gtttacgttg tctttggagt    6240

acaaagccag tagatacttc aaattcattt gaagttctgg cagtagaaga cacacaagga    6300

atggacaatc ttgcttgtga aagtcaacaa cccacctctg aagaagtagt ggaaaatcct    6360

accatacaga aggaagtcat agagtgtgac gtgaaaacta ccgaagttgt aggcaatgtc    6420

atacttaaac catcagatga aggtgttaaa gtaacacaag agttaggtca tgaggatctt    6480

atggctgctt atgtggaaaa cacaagcatt accattaaga aacctaatga gctttcacta    6540

gccttaggtt taaaaacaat tgccactcat ggtattgctg caattaatag tgttccttgg    6600

agtaaaattt tggcttatgt caaaccattc ttaggacaag cagcaattac aacatcaaat    6660

tgcgctaaga gattagcaca acgtgtgttt aacaattata tgccttatgt gtttacatta    6720

ttgttccaat tgtgtacttt tactaaaagt accaattcta gaattagagc ttcactacct    6780

acaactattg ctaaaaatag tgttaagagt gttgctaaat tatgtttgga tgccggcatt    6840

aattatgtga agtcacccaa attttctaaa ttgttcacaa tcgctatgtg gctattgttg    6900

ttaagtattt gcttaggttc tctaatctgt gtaactgctg cttttggtgt actcttatct    6960

aattttggtg ctccttctta ttgtaatggc gttagagaat tgtatcttaa ttcgtctaac    7020

gttactacta tggatttctg tgaaggttct tttccttgca gcatttgttt aagtggatta    7080

gactcccttg attcttatcc agctcttgaa accattcagg tgacgatttc atcgtacaag    7140

ctagacttga caattttagg tctggccgct gagtgggttt ggcatatat gttgttcaca     7200

aaattctttt atttattagg tctttcagct ataatgcagg tgttctttgg ctattttgct    7260

agtcatttca tcagcaattc ttggctcatg tggtttatca ttagtattgt acaaatggca    7320

cccgtttctg caatggttag gatgtacatc ttctttgctt ctttctacta catatggaag    7380

agctatgttc atatcatgga tggttgcacc tcttcgactt gcatgatgtg ctataagcgc    7440

aatcgtgcca cacgcgttga gtgtacaact attgttaatg gcatgaagag atctttctat    7500

gtctatgcaa atggaggccg tggcttctgc aagactcaca attggaattg tctcaattgt    7560
```

6

```
gacacatttt gcactggtag tacattcatt agtgatgaag ttgctcgtga tttgtcactc    7620

cagtttaaaa gaccaatcaa ccctactgac cagtcatcgt atattgttga tagtgttgct    7680

gtgaaaaatg gcgcgcttca cctctacttt gacaaggctg gtcaaaagac ctatgagaga    7740

catccgctct cccattttgt caatttagac aatttgagag ctaacaacac taaaggttca    7800

ctgcctatta atgtcatagt ttttgatggc aagtccaaat gcgacgagtc tgcttctaag    7860

tctgcttctg tgtactacag tcagctgatg tgccaaccta ttctgttgct tgaccaagtt    7920

cttgtatcag acgttggaga tagtactgaa gtttccgtta agatgtttga tgcttatgtc    7980

gacacctttt cagcaacttt tagtgttcct atggaaaaac ttaaggcact tgttgctaca    8040

gctcacagcg agttagcaaa gggtgtagct ttagatggtg tcctttctac attcgtgtca    8100

gctgcccgac aaggtgttgt tgataccgat gttgacacaa aggatgttat tgaatgtctc    8160

aaactttcac atcactctga cttagaagtg acaggtgaca gttgtaacaa tttcatgctc    8220

acctataata aggttgaaaa catgacgccc agagatcttg gcgcatgtat tgactgtaat    8280

gcaaggcata tcaatgccca agtagcaaaa agtcacaatg tttcactcat ctggaatgta    8340

aaagactaca tgtctttatc tgaacagctg cgtaaacaaa ttcgtagtgc tgccaagaag    8400

aacaacatac cttttagact aacttgtgct acaactagac aggttgtcaa tgtcataact    8460

actaaaatct cactcaaggg tggtaagatt gttagtactt gttttaaact tatgcttaag    8520

gccacattat tgtgcgttct tgctgcattg gtttgttata tcgttatgcc agtacataca    8580

ttgtcaatcc atgatggtta cacaaatgaa atcattggtt acaaagccat tcaggatggt    8640
gtcactcgtg acatcatttc tactgatgat tgttttgcaa ataaacatgc tggttttgac    8700

gcatggttta gccagcgtgg tggttcatac aaaaatgaca aaagctgccc tgtagtagct    8760

gctatcatta caagagagat tggtttcata gtgcctggct taccgggtac tgtgctgaga    8820

gcaatcaatg gtgacttctt gcattttcta cctcgtgttt ttagtgctgt tggcaacatt    8880

tgctacacac cttccaaact cattgagtat agtgattttg ctacctctgc ttgcgttctt    8940

gctgctgagt gtacaatttt taaggatgct atgggcaaac ctgtgccata ttgttatgac    9000

actaatttgc tagagggttc tatttcttat agtgagcttc gtccagacac tcgttatgtg    9060

cttatggatg gttccatcat acagtttcct aacacttacc tggagggttc tgttagagta    9120

gtaacaactt ttgatgctga gtactgtaga catggtacat gcgaaaggtc agaagtaggt    9180

atttgcctat ctaccagtgg tagatgggt  cttaataatg agcattacag agctctatca    9240

ggagttttct gtggtgttga tgcgatgaat ctcatagcta acatctttac tcctcttgtg    9300
```

7

```
caacctgtgg gtgctttaga tgtgtctgct tcagtagtgg ctggtggtat tattgccata   9360

ttggtgactt gtgctgccta ctactttatg aaattcagac gtgtttttgg tgagtacaac   9420

catgttgttg ctgctaatgc acttttgttt ttgatgtctt tcactatact ctgtctggta   9480

ccagcttaca gctttctgcc gggagtctac tcagtctttt acttgtactt gacattctat   9540

ttcaccaatg atgtttcatt cttggctcac cttcaatggt ttgccatgtt ttctcctatt   9600

gtgcctttt ggataacagc aatctatgta ttctgtattt ctctgaagca ctgccattgg   9660

ttctttaaca actatcttag gaaaagagtc atgtttaatg gagttacatt tagtaccttc   9720

gaggaggctg ctttgtgtac cttttttgctc aacaaggaaa tgtacctaaa attgcgtagc   9780

gagacactgt tgccacttac acagtataac aggtatcttg ctctatataa caagtacaag   9840

tatttcagtg gagccttaga tactaccagc tatcgtgaag cagcttgctg ccacttagca   9900

aaggctctaa atgactttag caactcaggt gctgatgttc tctaccaacc accacagaca   9960

tcaatcactt ctgctgttct gcagagtggt tttaggaaaa tggcattccc gtcaggcaaa   10020

gttgaagggt gcatggtaca agtaacctgt ggaactacaa ctcttaatgg attgtggttg   10080

gatgacacag tatactgtcc aagacatgtc atttgcacag cagaagacat gcttaatcct   10140

aactatgaag atctgctcat tcgcaaatcc aaccatagct ttcttgttca ggctggcaat   10200

gttcaacttc gtgttattgg ccattctatg caaaattgtc tgcttaggct taaagttgat   10260

acttctaacc ctaagacacc caagtataaa tttgtccgta tccaacctgg tcaaacattt   10320

tcagttctag catgctacaa tggttcacca tctggtgttt atcagtgtgc catgagacct   10380

aatcatacca ttaaaggttc tttccttaat ggatcatgtg gtagtgttgg ttttaacatt   10440

gattatgatt gcgtgtcttt ctgctatatg catcatatgg agcttccaac aggagtacac   10500

gctggtactg acttagaagg taaattctat ggtccatttg ttgacagaca aactgcacag   10560

gctgcaggta cagacacaac cataacatta aatgttttgg catggctgta tgctgctgtt   10620

atcaatggtg ataggtggtt tcttaataga ttcaccacta ctttgaatga cttttaacctt   10680

gtggcaatga agtacaacta tgaacctttg acacaagatc atgttgacat attgggacct   10740

ctttctgctc aaacaggaat tgccgtctta gatatgtgtg ctgctttgaa agagctgctg   10800

cagaatggta tgaatggtcg tactatcctt ggtagcacta ttttagaaga tgagtttaca   10860

ccatttgatg ttgttagaca atgctctggt gttaccttcc aaggtaagtt caagaaaatt   10920

gttaagggca ctcatcattg gatgcttta actttcttga catcactatt gattcttgtt   10980

caaagtacac agtggtcact gttttctttt gtttacgaga atgctttctt gccatttact   11040
```

8

```
cttggtatta tggcaattgc tgcatgtgct atgctgcttg ttaagcataa gcacgcattc  11100

ttgtgcttgt ttctgttacc ttctcttgca acagttgctt actttaatat ggtctacatg  11160

cctgctagct gggtgatgcg tatcatgaca tggcttgaat tggctgacac tagcttgtct  11220

ggttataggc ttaaggattg tgttatgtat gcttcagctt tagttttgct tattctcatg  11280

acagctcgca ctgtttatga tgatgctgct agacgtgttt ggacactgat gaatgtcatt  11340

acacttgttt acaaagtcta ctatggtaat gctttagatc aagctatttc catgtgggcc  11400

ttagttattt ctgtaacctc taactattct ggtgtcgtta cgactatcat gtttttagct  11460

agagctatag tgtttgtgtg tgttgagtat tacccattgt tatttattac tggcaacacc  11520

ttacagtgta tcatgcttgt ttattgtttc ttaggctatt gttgctgctg ctactttggc  11580

cttttctgtt tactcaaccg ttacttcagg cttactcttg gtgtttatga ctacttggtc  11640

tctacacaag aatttaggta tatgaactcc caggggcttt tgcctcctaa gagtagtatt  11700

gatgctttca agcttaacat taagttgttg ggtattggag gtaaaccatg tatcaaggtt  11760

gctactgtac agtctaaaat gtctgacgta aagtgcacat ctgtggtact gctctcggtt  11820

cttcaacaac ttagagtaga gtcatcttct aaattgtggg cacaatgtgt acaactccac  11880

aatgatattc ttcttgcaaa agacacaact gaagctttcg agaagatggt ttctcttttg  11940

tctgttttgc tatccatgca gggtgctgta gacattaata ggttgtgcga ggaaatgctc  12000

gataaccgtg ctactcttca ggctattgct tcagaattta gttctttacc atcatatgcc  12060

gcttatgcca ctgcccagga ggcctatgag caggctgtag ctaatggtga ttctgaagtc  12120

gttctcaaaa agttaaagaa atctttgaat gtggctaaat ctgagtttga ccgtgatgct  12180

gccatgcaac gcaagttgga aaagatggca gatcaggcta tgacccaaat gtacaaacag  12240

gcaagatctg aggacaagag ggcaaaagta actagtgcta tgcaaacaat gctcttcact  12300

atgcttagga agcttgataa tgatgcactt aacaacatta tcaacaatgc gcgtgatggt  12360

tgtgttccac tcaacatcat accattgact acagcagcca aactcatggt tgttgtccct  12420

gattatggta cctacaagaa cacttgtgat ggtaacacct ttacatatgc atctgcactc  12480
tgggaaatcc agcaagttgt tgatgcggat agcaagattg ttcaacttag tgaaattaac  12540

atggacaatt caccaaattt ggcttggcct cttattgtta cagctctaag agccaactca  12600

gctgttaaac tacagaataa tgaactgagt ccagtagcac tacgacagat gtcctgtgcg  12660

gctggtacca cacaaacagc ttgtactgat gacaatgcac ttgcctacta taacaattcg  12720

aagggaggta ggtttgtgct ggcattacta tcagaccacc aagatctcaa atgggctaga  12780
```

9

```
ttccctaaga gtgatggtac aggtacaatt tacacagaac tggaaccacc ttgtaggttt    12840

gttacagaca caccaaaagg gcctaaagtg aaatacttgt acttcatcaa aggcttaaac    12900

aacctaaata gaggtatggt gctgggcagt ttagctgcta cagtacgtct tcaggctgga    12960

aatgctacag aagtacctgc caattcaact gtgctttcct tctgtgcttt tgcagtagac    13020

cctgctaaag catataagga ttacctagca agtggaggac aaccaatcac caactgtgtg    13080

aagatgttgt gtacacacac tggtacagga caggcaatta ctgtaacacc agaagctaac    13140

atggaccaag agtcctttgg tggtgcttca tgttgtctgt attgtagatg ccacattgac    13200

catccaaatc ctaaaggatt ctgtgacttg aaaggtaagt acgtccaaat acctaccact    13260

tgtgctaatg acccagtggg ttttacactt agaaacacag tctgtaccgt ctgcggaatg    13320

tggaaaggtt atggctgtag ttgtgaccaa ctccgcgaac ccttgatgca gtctgcggat    13380

gcatcaacgt ttttaaacgg gtttgcggtg taagtgcagc ccgtcttaca ccgtgcggca    13440

caggcactag tactgatgtc gtctacaggg cttttgatat ttacaacgaa aaagttgctg    13500

gttttgcaaa gttcctaaaa actaattgct gtcgcttcca ggagaaggat gaggaaggca    13560

atttattaga ctcttacttt gtagttaaga ggcatactat gtctaactac caacatgaag    13620

agactattta taacttggtt aaagattgtc cagcggttgc tgtccatgac ttttttcaagt    13680

ttagagtaga tggtgacatg gtaccacata tatcacgtca gcgtctaact aaatacacaa    13740

tggctgattt agtctatgct ctacgtcatt ttgatgaggg taattgtgat acattaaaag    13800

aaatactcgt cacatacaat tgctgtgatg atgattattt caataagaag gattggtatg    13860

acttcgtaga gaatcctgac atcttacgcg tatatgctaa cttaggtgag cgtgtacgcc    13920

aatcattatt aaagactgta caattctgcg atgctatgcg tgatgcaggc attgtaggcg    13980

tactgacatt agataatcag gatcttaatg ggaactggta cgatttcggt gatttcgtac    14040

aagtagcacc aggctgcgga gttcctattg tggattcata ttactcattg ctgatgccca    14100

tcctcacttt gactagggca ttggctgctg agtcccatat ggatgctgat ctcgcaaaac    14160

cacttattaa gtgggatttg ctgaaatatg attttacgga agagagactt tgtctcttcg    14220

accgttattt taaatattgg gaccagacat accatcccaa ttgtattaac tgtttggatg    14280

ataggtgtat ccttcattgt gcaaacttta atgtgttatt ttctactgtg tttccaccta    14340

caagttttgg accactagta agaaaaatat ttgtagatgg tgttcctttt gttgtttcaa    14400

ctggatacca ttttcgtgag ttaggagtcg tacataatca ggatgtaaac ttacatagct    14460
```

10

```
cgcgtctcag tttcaaggaa cttttagtgt atgctgctga tccagctatg catgcagctt   14520

ctggcaattt attgctagat aaacgcacta catgcttttc agtagctgca ctaacaaaca   14580

atgttgcttt tcaaactgtc aaacccggta attttaataa agacttttat gactttgctg   14640

tgtctaaagg tttctttaag gaaggaagtt ctgttgaact aaaacacttc ttctttgctc   14700

aggatggcaa cgctgctatc agtgattatg actattatcg ttataatctg ccaacaatgt   14760

gtgatatcag acaactccta ttcgtagttg aagttgttga taaatacttt gattgttacg   14820

atggtggctg tattaatgcc aaccaagtaa tcgttaacaa tctggataaa tcagctggtt   14880

tcccatttaa taaatggggt aaggctagac tttattatga ctcaatgagt tatgaggatc   14940

aagatgcact tttcgcgtat actaagcgta atgtcatccc tactataact caaatgaatc   15000

ttaagtatgc cattagtgca aagaatagag ctcgcaccgt agctggtgtc tctatctgta   15060

gtactatgac aaatagacag tttcatcaga aattattgaa gtcaatagcc gccactagag   15120

gagctactgt ggtaattgga acaagcaagt tttacggtgg ctggcataat atgttaaaaa   15180

ctgtttacag tgatgtagaa actccacacc ttatgggttg ggattatcca aaatgtgaca   15240

gagccatgcc taacatgctt aggataatgg cctctcttgt tcttgctcgc aaacataaca   15300

cttgctgtaa cttatcacac cgtttctaca ggttagctaa cgagtgtgcg caagtattaa   15360

gtgagatggt catgtgtggc ggctcactat atgttaaacc aggtggaaca tcatccggtg   15420

atgctacaac tgcttatgct aatagtgtct ttaacatttg tcaagctgtt acagccaatg   15480

taaatgcact tctttcaact gatggtaata agatagctga caagtatgtc cgcaatctac   15540

aacacaggct ctatgagtgt ctctatagaa atagggatgt tgatcatgaa ttcgtggatg   15600

agttttacgc ttacctgcgt aaacatttct ccatgatgat tctttctgat gatgccgttg   15660

tgtgctataa cagtaactat gcggctcaag gtttagtagc tagcattaag aactttaagg   15720

cagttcttta ttatcaaaat aatgtgttca tgtctgaggc aaaatgttgg actgagactg   15780

accttactaa aggacctcac gaattttgct cacagcatac aatgctagtt aaacaaggag   15840

atgattacgt gtacctgcct tacccagatc catcaagaat attaggcgca ggctgttttg   15900

tcgatgatat tgtcaaaaca gatggtacac ttatgattga aggttcgtg tcactggcta   15960

ttgatgctta cccacttaca aaacatccta atcaggagta tgctgatgtc tttcacttgt   16020

atttacaata cattagaaag ttacatgatg agcttactgg ccacatgttg gacatgtatt   16080

ccgtaatgct aactaatgat aacacctcac ggtactggga acctgagttt tatgaggcta   16140

tgtacacacc acatacagtc ttgcaggctg taggtgcttg tgtattgtgc aattcacaga   16200
```

11

```
cttcacttcg ttgcggtgcc tgtattagga gaccattcct atgttgcaag tgctgctatg   16260

accatgtcat ttcaacatca cacaaattag tgttgtctgt taatccctat gtttgcaatg   16320
ccccaggttg tgatgtcact gatgtgacac aactgtatct aggaggtatg agctattatt   16380

gcaagtcaca taagcctccc attagttttc cattatgtgc taatggtcag gtttttggtt   16440

tatacaaaaa cacatgtgta ggcagtgaca atgtcactga cttcaatgcg atagcaacat   16500

gtgattggac taatgctggc gattacatac ttgccaacac ttgtactgag agactcaagc   16560

ttttcgcagc agaaacgctc aaagccactg aggaaacatt taagctgtca tatggtattg   16620

ctactgtacg cgaagtactc tctgacagag aattgcatct ttcatgggag gttggaaaac   16680

ctagaccacc attgaacaga aactatgtct ttactggtta ccgtgtaact aaaaatagta   16740

aagtacagat tggagagtac acctttgaaa aaggtgacta tggtgatgct gttgtgtaca   16800

gaggtactac gacatacaag ttgaatgttg gtgattactt tgtgttgaca tctcacactg   16860

taatgccact tagtgcacct actctagtgc cacaagagca ctatgtgaga attactggct   16920

tgtacccaac actcaacatc tcagatgagt tttctagcaa tgttgcaaat tatcaaaagg   16980

tcggcatgca aaagtactct acactccaag gaccacctgg tactggtaag agtcattttg   17040

ccatcggact tgctctctat tacccatctg ctcgcatagt gtatacggca tgctctcatg   17100

cagctgttga tgccctatgt gaaaaggcat taaaatattt gcccatagat aaatgtagta   17160

gaatcatacc tgcgcgtgcg cgcgtagagt gttttgataa attcaaagtg aattcaacac   17220

tagaacagta tgttttctgc actgtaaatg cattgccaga aacaactgct gacattgtag   17280

tctttgatga aatctctatg gctactaatt atgacttgag tgttgtcaat gctagacttc   17340

gtgcaaaaca ctacgtctat attggcgatc ctgctcaatt accagccccc cgcacattgc   17400

tgactaaagg cacactagaa ccagaatatt ttaattcagt gtgcagactt atgaaaacaa   17460

taggtccaga catgttcctt ggaacttgtc gccgttgtcc tgctgaaatt gttgacactg   17520

tgagtgcttt agtttatgac aataagctaa aagcacacaa ggataagtca gctcaatgct   17580

tcaaaatgtt ctacaaaggt gttattacac atgatgtttc atctgcaatc aacagacctc   17640

aaataggcgt tgtaagagaa tttcttacac gcaatcctgc ttggagaaaa gctgtttttta  17700

tctcacctta taattcacag aacgctgtag cttcaaaaat cttaggattg cctacgcaga   17760

ctgttgattc atcacagggt tctgaatatg actatgtcat attcacacaa actactgaaa   17820

cagcacactc ttgtaatgtc aaccgcttca atgtggctat cacaagggca aaaattggca   17880

ttttgtgcat aatgtctgat agagatcttt atgacaaact gcaatttaca agtctagaaa   17940
```
12

```
taccacgtcg caatgtggct acattacaag cagaaaatgt aactggactt tttaaggact   18000

gtagtaagat cattactggt cttcatccta cacaggcacc tacacacctc agcgttgata   18060

taaagttcaa gactgaagga ttatgtgttg acataccagg cataccaaag gacatgacct   18120

accgtagact catctctatg atgggtttca aaatgaatta ccaagtcaat ggttacccta   18180

atatgtttat cacccgcgaa gaagctattc gtcacgttcg tgcgtggatt ggctttgatg   18240

tagagggctg tcatgcaact agagatgctg tgggtactaa cctacctctc cagctaggat   18300

tttctacagg tgttaactta gtagctgtac cgactggtta tgttgacact gaaaataaca   18360

cagaattcac cagagttaat gcaaaacctc caccaggtga ccagtttaaa catcttatac   18420

cactcatgta taaaggcttg ccctggaatg tagtgcgtat taagatagta caaatgctca   18480

gtgatacact gaaaggattg tcagacagag tcgtgttcgt cctttgggcg catggctttg   18540

agcttacatc aatgaagtac tttgtcaaga ttggacctga aagaacgtgt tgtctgtgtg   18600

acaaacgtgc aacttgcttt tctacttcat cagatactta tgcctgctgg aatcattctg   18660

tgggttttga ctatgtctat aacccattta tgattgatgt tcagcagtgg ggctttacgg   18720

gtaaccttca gagtaaccat gaccaacatt gccaggtaca tggaaatgca catgtggcta   18780

gttgtgatgc tatcatgact agatgtttag cagtccatga gtgctttgtt aagcgcgttg   18840

attggtctgt tgaataccct attataggag atgaactgag ggttaattct gcttgcagaa   18900

aagtacaaca catggttgtg aagtctgcat tgcttgctga taagtttcca gttcttcatg   18960

acattggaaa tccaaaggct atcaagtgtg tgcctcaggc tgaagtagaa tggaagttct   19020

acgatgctca gccatgtagt gacaaagctt acaaaataga ggagctcttc tattcttatg   19080

ctacacatca cgataaattc actgatggtg tttgtttgtt ttggaattgt aacgttgatc   19140

gttacccagc caatgcaatt gtgtgtaggt ttgacacaag agccttgtca aacttgaact   19200

taccaggctg tgatggtggt agtttgtatg tgaataagca tgcattccac actccagctt   19260

tcgataaaag tgcatttact aatttaaagc aattgccttt cttttactat tctgatagtc   19320

cttgtgagtc tcatggcaaa caagtagtgt cggatattga ttatgttcca ctcaaatctg   19380

ctacgtgtat tacacgatgc aatttaggtg gtgctgtttg cagacaccat gcaaatgagt   19440

accgacagta cttggatgca tataatatga tgatttctgc tggatttagc ctatggattt   19500

acaaacaatt tgatacttat aacctgtgga atacatttac caggttacag agtttagaaa   19560

atgtggctta taatgttgtt aataaaggac actttgatgg acacgccggc gaagcacctg   19620
```

```
tttccatcat taataatgct gtttacacaa aggtagatgg tattgatgtg gagatctttg   19680

aaaataagac aacacttcct gttaatgttg catttgagct ttgggctaag cgtaacatta   19740

aaccagtgcc agagattaag atactcaata atttgggtgt tgatatcgct gctaatactg   19800

taatctggga ctacaaaaga gaagccccag cacatgtatc tacaataggt gtctgcacaa   19860

tgactgacat tgccaagaaa cctactgaga gtgcttgttc ttcacttact gtcttgtttg   19920

atggtagagt ggaaggacag gtagaccttt ttagaaacgc ccgtaatggt gttttaataa   19980

cagaaggttc agtcaaaggt ctaacacctt caaagggacc agcacaagct agcgtcaatg   20040

gagtcacatt aattggagaa tcagtaaaaa cacagtttaa ctactttaag aaagtagacg   20100

gcattattca acagttgcct gaaacctact ttactcagag cagagactta gaggatttta   20160
agcccagatc acaaatggaa actgactttc tcgagctcgc tatggatgaa ttcatacagc   20220

gatataagct cgagggctat gccttcgaac acatcgttta tggagatttc agtcatggac   20280

aacttggcgg tcttcattta atgataggct tagccaagcg ctcacaagat tcaccactta   20340

aattagagga tttttatccct atggacagca cagtgaaaaa ttacttcata acagatgcgc   20400

aaacaggttc atcaaaatgt gtgtgttctg tgattgatct tttacttgat gactttgtcg   20460

agataataaa gtcacaagat ttgtcagtga tttcaaaagt ggtcaaggtt acaattgact   20520

atgctgaaat ttcattcatg ctttggtgta aggatggaca tgttgaaacc ttctacccaa   20580

aactacaagc aagtcaagcg tggcaaccag gtgttgcgat gcctaacttg tacaagatgc   20640

aaagaatgct tcttgaaaag tgtgaccttc agaattatgg tgaaaatgct gttataccaa   20700

aaggaataat gatgaatgtc gcaaagtata ctcaactgtg tcaatactta aatacactta   20760

ctttagctgt accctacaac atgagagtta ttcactttgg tgctggctct gataaaggag   20820

ttgcaccagg tacagctgtg ctcagacaat ggttgccaac tggcacacta cttgtcgatt   20880

cagatcttaa tgacttcgtc tccgacgcag attctacttt aattggagac tgtgcaacag   20940

tacatacggc taataaatgg gaccttatta ttagcgatat gtatgaccct aggaccaaac   21000

atgtgacaaa agagaatgac tctaaagaag ggttttcac ttatctgtgt ggatttataa    21060

agcaaaaact agccctgggt ggttctatag ctgtaaagat aacagagcat tcttggaatg   21120

ctgacctttta caagcttatg ggccatttct catggtggac agcttttgtt acaaatgtaa   21180

atgcatcatc atcggaagca tttttaattg gggctaacta tcttggcaag ccgaaggaac   21240

aaattgatgg ctataccatg catgctaact acattttctg gaggaacaca aatcctatcc   21300

agttgtcttc ctattcactc tttgacatga gcaaatttcc tcttaaatta agaggaactg   21360
```

14

```
ctgtaatgtc tcttaaggag aatcaaatca atgatatgat ttattctctt ctggaaaaag  21420

gtaggcttat cattagagaa aacaacagag ttgtggtttc aagtgatatt cttgttaaca  21480

actaaacgaa catgtttatt ttcttattat ttcttactct cactagtggt agtgaccttg  21540

accggtgcac cacttttgat gatgttcaag ctcctaatta cactcaacat acttcatcta  21600

tgagggggt ttactatcct gatgaaattt ttagatcaga cactctttat ttaactcagg  21660

atttatttct tccattttat tctaatgtta cagggtttca tactattaat catacgtttg  21720

gcaaccctgt catacctttt aaggatggta tttattttgc tgccacagag aaatcaaatg  21780

ttgtccgtgg ttgggttttt ggttctacca tgaacaacaa gtcacagtcg gtgattatta  21840

ttaacaattc tactaatgtt gttatacgag catgtaactt tgaattgtgt gacaaccctt  21900

tctttgctgt ttctaaaccc atgggtacac agacacatac tatgatattc gataatgcat  21960

ttaattgcac tttcgagtac atatctgatg ccttttcgct tgatgtttca gaaaagtcag  22020

gtaattttaa acacttacga gagttgtgt ttaaaaataa agatgggttt ctctatgttt  22080

ataagggcta tcaacctata gatgtagttc gtgatctacc ttctggtttt aacactttga  22140

aacctatttt taagttgcct cttggtatta acattacaaa ttttagagcc attcttacag  22200

ccttttcacc tgctcaagac atttggggca cgtcagctgc agcctatttt gttggctatt  22260

taaagccaac tacatttatg ctcaagtatg atgaaaatgg tacaatcaca gatgctgttg  22320

attgttctca aaatccactt gctgaactca aatgctctgt taagagcttt gagattgaca  22380

aaggaattta ccagacctct aatttcaggg ttgttccctc aggagatgtt gtgagattcc  22440

ctaatattac aaacttgtgt ccttttggag aggtttttaa tgctactaaa ttcccttctg  22500

tctatgcatg ggagagaaaa aaaatttcta attgtgttgc tgattactct gtgctctaca  22560

actcaacatt tttttcaacc tttaagtgct atggcgtttc tgccactaag ttgaatgatc  22620

tttgcttctc caatgtctat gcagattctt ttgtagtcaa gggagatgat gtaagacaaa  22680

tagcgccagg acaaactggt gttattgctg attataatta taaattgcca gatgatttca  22740

tgggttgtgt ccttgcttgg aatactagga acattgatgc tacttcaact ggtaattata  22800

attataaata taggtatctt agacatggca agcttaggcc ctttgagaga gacatatcta  22860

atgtgccttt ctccctgat ggcaaacctt gcacccacc tgctcttaat tgttattggc  22920

cattaaatga ttatggtttt tacaccacta ctggcattgg ctaccaacct tacagagttg  22980

tagtactttc ttttgaactt ttaaatgcac cggccacggt ttgtggacca aaattatcca  23040

ctgaccttat taagaaccag tgtgtcaatt ttaattttaa tggactcact ggtactggtg  23100
```

15

```
tgttaactcc ttcttcaaag agatttcaac catttcaaca atttggccgt gatgtttctg   23160

atttcactga ttccgttcga gatcctaaaa catctgaaat attagacatt tcaccttgct   23220

cttttggggg tgtaagtgta attacacctg gaacaaatgc ttcatctgaa gttgctgttc   23280

tatatcaaga tgttaactgc actgatgttt ctacagcaat tcatgcagat caactcacac   23340

cagcttggcg catatattct actggaaaca atgtattcca gactcaagca ggctgtctta   23400

taggagctga gcatgtcgac acttcttatg agtgcgacat tcctattgga gctggcattt   23460

gtgctagtta ccatacagtt tctttattac gtagtactag ccaaaaatct attgtggctt   23520

atactatgtc tttaggtgct gatagttcaa ttgcttactc taataacacc attgctatac   23580

ctactaactt ttcaattagc attactacag aagtaatgcc tgtttctatg gctaaaacct   23640

ccgtagattg taatatgtac atctgcggag attctactga atgtgctaat ttgcttctcc   23700

aatatggtag cttttgcaca caactaaatc gtgcactctc aggtattgct gctgaacagg   23760

atcgcaacac acgtgaagtg ttcgctcaag tcaaacaaat gtacaaaacc ccaactttga   23820

aatattttgg tggtttttaat ttttcacaaa tattacctga ccctctaaag ccaactaaga   23880

ggtcttttat tgaggacttg ctctttaata aggtgacact cgctgatgct ggcttcatga   23940

agcaatatgg cgaatgccta ggtgatatta atgctagaga tctcatttgt gcgcagaagt   24000
tcaatggact tacagtgttg ccacctctgc tcactgatga tatgattgct gcctacactg   24060

ctgctctagt tagtggtact gccactgctg gatggacatt tggtgctggc gctgctcttc   24120

aaataccttt tgctatgcaa atggcatata ggttcaatgg cattggagtt acccaaaatg   24180

ttctctatga gaaccaaaaa caaatcgcca accaatttaa caaggcgatt agtcaaattc   24240

aagaatcact tacaacaaca tcaactgcat tgggcaagct gcaagacgtt gttaaccaga   24300

atgctcaagc attaaacaca cttgttaaac aacttagctc taattttggt gcaatttcaa   24360

gtgtgctaaa tgatatcctt tcgcgacttg ataaagtcga ggcggaggta caaattgaca   24420

ggttaattac aggcagactt caaagccttc aaacctatgt aacacaacaa ctaatcaggg   24480

ctgctgaaat cagggcttct gctaatcttg ctgctactaa aatgtctgag tgtgttcttg   24540

gacaatcaaa aagagttgac ttttgtggaa agggctacca ccttatgtcc ttcccacaag   24600

cagccccgca tggtgttgtc ttcctacatg tcacgtatgt gccatcccag gagaggaact   24660

tcaccacagc gccagcaatt tgtcatgaag gcaaagcata cttccctcgt gaaggtgttt   24720

ttgtgtttaa tggcacttct tggtttatta cacagaggaa cttcttttct ccacaaataa   24780

ttactacaga caatacattt gtctcaggaa attgtgatgt cgttattggc atcattaaca   24840
```
16

```
acacagttta tgatcctctg caacctgagc tcgactcatt caaagaagag ctggacaagt   24900

acttcaaaaa tcatacatca ccagatgttg atcttggcga catttcaggc attaacgctt   24960

ctgtcgtcaa cattcaaaaa gaaattgacc gcctcaatga ggtcgctaaa aatttaaatg   25020

aatcactcat tgaccttcaa gaattgggaa aatatgagca atatattaaa tggccttggt   25080

atgtttggct cggcttcatt gctggactaa ttgccatcgt catggttaca atcttgcttt   25140

gttgcatgac tagttgttgc agttgcctca agggtgcatg ctcttgtggt tcttgctgca   25200

agtttgatga ggatgactct gagccagttc tcaagggtgt caaattacat tacacataaa   25260

cgaacttatg gatttgttta tgagattttt tactcttgga tcaattactg cacagccagt   25320

aaaaattgac aatgcttctc ctgcaagtac tgttcatgct acagcaacga taccgctaca   25380

agcctcactc cctttcggat ggcttgttat tggcgttgca tttcttgctg tttttcagag   25440

cgctaccaaa ataattgcgc tcaataaaag atggcagcta gccctttata agggcttcca   25500

gttcatttgc aatttactgc tgctatttgt taccatctat tcacatcttt tgcttgtcgc   25560

tgcaggtatg gaggcgcaat ttttgtacct ctatgccttg atatattttc tacaatgcat   25620

caacgcatgt agaattatta tgagatgttg gctttgttgg aagtgcaaat ccaagaaccc   25680

attactttat gatgccaact actttgtttg ctggcacaca cataactatg actactgtat   25740

accatataac agtgtcacag atacaattgt cgttactgaa ggtgacggca tttcaacacc   25800

aaaactcaaa gaagactacc aaattggtgg ttattctgag dataggcact caggtgttaa   25860

agactatgtc gttgtacatg gctatttcac cgaagtttac taccagcttg agtctacaca   25920

aattactaca gacactggta ttgaaaatgc tacattcttc atctttaaca agcttgttaa   25980

agacccaccg aatgtgcaaa tacacacaat cgacggctct tcaggagttg ctaatccagc   26040

aatggatcca atttatgatg agccgacgac gactactagc gtgcctttgt aagcacaaga   26100

aagtgagtac gaacttatgt actcattcgt ttcggaagaa acaggtacgt taatagttaa   26160

tagcgtactt ctttttcttg ctttcgtggt attcttgcta gtcacactag ccatccttac   26220

tgcgcttcga ttgtgtgcgt actgctgcaa tattgttaac gtgagtttag taaaaccaac   26280

ggtttacgtc tactcgcgtg ttaaaaatct gaactcttct gaaggagttc ctgatcttct   26340

ggtctaaacg aactaactat tattattatt ctgtttggaa ctttaacatt gcttatcatg   26400

gcagacaacg gtactattac cgttgaggag cttaaacaac tcctggaaca atggaaccta   26460

gtaataggtt tcctattcct agcctggatt atgttactac aatttgccta ttctaatcgg   26520
```

17

```
aacaggtttt tgtacataat aaagcttgtt ttcctctggc tcttgtggcc agtaacactt  26580

gcttgttttg tgcttgctgc tgtctacaga attaattggg tgactggcgg gattgcgatt  26640

gcaatggctt gtattgtagg cttgatgtgg cttagctact tcgttgcttc cttcaggctg  26700

tttgctcgta cccgctcaat gtggtcattc aacccagaaa caaacattct tctcaatgtg  26760

cctctccggg ggacaattgt gaccagaccg ctcatggaaa gtgaacttgt cattggtgct  26820

gtgatcattc gtggtcactt gcgaatggcc ggacaccccc tagggcgctg tgacattaag  26880

gacctgccaa aagagatcac tgtggctaca tcacgaacgc tttcttatta caaattagga  26940

gcgtcgcagc gtgtaggcac tgattcaggt tttgctgcat acaaccgcta ccgtattgga  27000

aactataaat taaatacaga ccacgccggt agcaacgaca atattgcttt gctagtacag  27060

taagtgacaa cagatgtttc atcttgttga cttccaggtt acaatagcag agatattgat  27120

tatcattatg aggactttca ggattgctat ttggaatctt gacgttataa taagttcaat  27180

agtgagacaa ttatttaagc ctctaactaa gaagaattat tcggagttag atgatgaaga  27240

acctatggag ttagattatc cataaaacga acatgaaaat tattctcttc ctgacattga  27300

ttgtatttac atcttgcgag ctatatcact atcaggagtg tgttagaggt acgactgtac  27360

tactaaaaga accttgccca tcaggaacat acgagggcaa ttcaccattt caccctcttg  27420

ctgacaataa atttgcacta acttgcacta gcacacactt tgcttttgct tgtgctgacg  27480

gtactcgaca tacctatcag ctgcgtgcaa gatcagtttc accaaaactt ttcatcagac  27540

aagaggaggt tcaacaagag ctctactcgc cactttttct cattgttgct gctctagtat  27600

ttttaatact ttgcttcacc attaagagaa agacagaatg aatgagctca ctttaattga  27660

cttctatttg tgcttttttag cctttctgct attccttgtt ttaataatgc ttattatatt  27720

ttggttttca ctcgaaatcc aggatctaga agaaccttgt accaaagtct aaacgaacat  27780

gaaacttctc attgttttga cttgtatttc tctatgcagt tgcatatgca ctgtagtaca  27840
gcgctgtgca tctaataaac ctcatgtgct tgaagatcct tgtaaggtac aacactaggg  27900

gtaatactta tagcactgct tggctttgtg ctctaggaaa ggttttacct tttcatagat  27960

ggcacactat ggttcaaaca tgcacaccta atgttactat caactgtcaa gatccagctg  28020

gtggtgcgct tatagctagg tgttggtacc ttcatgaagg tcaccaaact gctgcattta  28080

gagacgtact tgttgtttta aataaacgaa caaattaaaa tgtctgataa tggaccccaa  28140

tcaaaccaac gtagtgcccc ccgcattaca tttggtggac ccacagattc aactgacaat  28200

aaccagaatg gaggacgcaa tggggcaagg ccaaaacagc gccgacccca aggtttaccc  28260
```

18

```
aataatactg cgtcttggtt cacagctctc actcagcatg gcaaggagga acttagattc    28320

cctcgaggcc agggcgttcc aatcaacacc aatagtggtc cagatgacca aattggctac    28380

taccgaagag ctacccgacg agttcgtggt ggtgacggca aaatgaaaga gctcagcccc    28440

agatggtact tctattacct aggaactggc ccagaagctt cacttcccta cggcgctaac    28500

aaagaaggca tcgtatgggt tgcaactgag ggagccttga atacacccaa agaccacatt    28560

ggcacccgca atcctaataa caatgctgcc accgtgctac aacttcctca aggaacaaca    28620

ttgccaaaag gcttctacgc agagggaagc agaggcggca gtcaagcctc ttctcgctcc    28680

tcatcacgta gtcgcggtaa ttcaagaaat tcaactcctg gcagcagtag gggaaattct    28740

cctgctcgaa tggctagcgg aggtggtgaa actgccctcg cgctattgct gctagacaga    28800

ttgaaccagc ttgagagcaa agtttctggt aaaggccaac aacaacaagg ccaaactgtc    28860

actaagaaat ctgctgctga ggcatctaaa aagcctcgcc aaaaacgtac tgccacaaaa    28920

cagtacaacg tcactcaagc atttgggaga cgtggtccag aacaaaccca aggaaatttc    28980

ggggaccaag acctaatcag acaaggaact gattacaaac attggccgca aattgcacaa    29040

tttgctccaa gtgcctctgc attctttgga atgtcacgca ttggcatgga agtcacacct    29100

tcgggaacat ggctgactta tcatggagcc attaaattgg atgacaaaga tccacaattc    29160

aaagacaacg tcatactgct gaacaagcac attgacgcat acaaaacatt cccaccaaca    29220

gagcctaaaa aggacaaaaa gaaaaagact gatgaagctc agcctttgcc gcagagacaa    29280

aagaagcagc ccactgtgac tcttcttcct gcggctgaca tggatgattt ctccagacaa    29340

cttcaaaatt ccatgagtgg agcttctgct gattcaactc aggcataaac actcatgatg    29400

accacacaag gcagatgggc tatgtaaacg ttttcgcaat tccgtttacg atacatagtc    29460

tactcttgtg cagaatgaat tctcgtaact aaacagcaca agtaggttta gttaacttta    29520

atctcacata gcaatcttta atcaatgtgt aacattaggg aggacttgaa agagccacca    29580

cattttcatc gaggccacgc ggagtacgat cgagggtaca gtgaataatg ctaggagag    29640

ctgcctatat ggaagagccc taatgtgtaa aattaatttt agtagtgcta tccccatgtg    29700

attttaatag cttcttagga gaatgac                                        .    29727
```

<210> 2
<211> 4382
<212> PRT
<213> Coronavirus

<400> 2

19

```
Met Glu Ser Leu Val Leu Gly Val Asn Glu Lys Thr His Val Gln Leu
1           5               10              15


Ser Leu Pro Val Leu Gln Val Arg Asp Val Leu Val Arg Gly Phe Gly
        20              25              30


Asp Ser Val Glu Glu Ala Leu Ser Glu Ala Arg Glu His Leu Lys Asn
        35              40              45


Gly Thr Cys Gly Leu Val Glu Leu Glu Lys Gly Val Leu Pro Gln Leu
        50              55              60


Glu Gln Pro Tyr Val Phe Ile Lys Arg Ser Asp Ala Leu Ser Thr Asn
65              70              75              80


His Gly His Lys Val Val Glu Leu Val Ala Glu Met Asp Gly Ile Gln
                85              90              95


Tyr Gly Arg Ser Gly Ile Thr Leu Gly Val Leu Val Pro His Val Gly
            100             105             110


Glu Thr Pro Ile Ala Tyr Arg Asn Val Leu Leu Arg Lys Asn Gly Asn
        115             120             125


Lys Gly Ala Gly Gly His Ser Tyr Gly Ile Asp Leu Lys Ser Tyr Asp
        130             135             140


Leu Gly Asp Glu Leu Gly Thr Asp Pro Ile Glu Asp Tyr Glu Gln Asn
145             150             155             160


Trp Asn Thr Lys His Gly Ser Gly Ala Leu Arg Glu Leu Thr Arg Glu
                165             170             175


Leu Asn Gly Gly Ala Val Thr Arg Tyr Val Asp Asn Asn Phe Cys Gly
        180             185             190


Pro Asp Gly Tyr Pro Leu Asp Cys Ile Lys Asp Phe Leu Ala Arg Ala
        195             200             205


Gly Lys Ser Met Cys Thr Leu Ser Glu Gln Leu Asp Tyr Ile Glu Ser
        210             215             220
```

20

```
Lys Arg Gly Val Tyr Cys Cys Arg Asp His Glu His Glu Ile Ala Trp
225             230         235             240


Phe Thr Glu Arg Ser Asp Lys Ser Tyr Glu His Gln Thr Pro Phe Glu
            245             250             255


Ile Lys Ser Ala Lys Lys Phe Asp Thr Phe Lys Gly Glu Cys Pro Lys
        260             265             270


Phe Val Phe Pro Leu Asn Ser Lys Val Lys Val Ile Gln Pro Arg Val
        275             280             285


Glu Lys Lys Lys Thr Glu Gly Phe Met Gly Arg Ile Arg Ser Val Tyr
    290             295             300


Pro Val Ala Ser Pro Gln Glu Cys Asn Asn Met His Leu Ser Thr Leu
305             310             315             320


Met Lys Cys Asn His Cys Asp Glu Val Ser Trp Gln Thr Cys Asp Phe
            325             330             335


Leu Lys Ala Thr Cys Glu His Cys Gly Thr Glu Asn Leu Val Ile Glu
            340             345             350


Gly Pro Thr Thr Cys Gly Tyr Leu Pro Thr Asn Ala Val Val Lys Met
        355             360             365


Pro Cys Pro Ala Cys Gln Asp Pro Glu Ile Gly Pro Glu His Ser Val
    370             375             380


Ala Asp Tyr His Asn His Ser Asn Ile Glu Thr Arg Leu Arg Lys Gly
385             390             395             400


Gly Arg Thr Arg Cys Phe Gly Gly Cys Val Phe Ala Tyr Val Gly Cys
            405             410             415


Tyr Asn Lys Arg Ala Tyr Trp Val Pro Arg Ala Ser Ala Asp Ile Gly
        420             425             430


Ser Gly His Thr Gly Ile Thr Gly Asp Asn Val Glu Thr Leu Asn Glu
        435             440             445


Asp Leu Leu Glu Ile Leu Ser Arg Glu Arg Val Asn Ile Asn Ile Val
                        21
```

```
            450                 455                 460


Gly Asp Phe His Leu Asn Glu Glu Val Ala Ile Ile Leu Ala Ser Phe
465                 470                 475                 480


Ser Ala Ser Thr Ser Ala Phe Ile Asp Thr Ile Lys Ser Leu Asp Tyr
                485                 490                 495


Lys Ser Phe Lys Thr Ile Val Glu Ser Cys Gly Asn Tyr Lys Val Thr
                500                 505                 510


Lys Gly Lys Pro Val Lys Gly Ala Trp Asn Ile Gly Gln Gln Arg Ser
                515                 520                 525


Val Leu Thr Pro Leu Cys Gly Phe Pro Ser Gln Ala Ala Gly Val Ile
        530                 535                 540


Arg Ser Ile Phe Ala Arg Thr Leu Asp Ala Ala Asn His Ser Ile Pro
545                 550                 555                 560


Asp Leu Gln Arg Ala Ala Val Thr Ile Leu Asp Gly Ile Ser Glu Gln
                565                 570                 575                 .


Ser Leu Arg Leu Val Asp Ala Met Val Tyr Thr Ser Asp Leu Leu Thr
                580                 585                 590


Asn Ser Val Ile Ile Met Ala Tyr Val Thr Gly Gly Leu Val Gln Gln
                595                 600                 605


Thr Ser Gln Trp Leu Ser Asn Leu Leu Gly Thr Thr Val Glu Lys Leu
        610                 615                 620                 .


Arg Pro Ile Phe Glu Trp Ile Glu Ala Lys Leu Ser Ala Gly Val Glu
625                 630                 635                 640


Phe Leu Lys Asp Ala Trp Glu Ile Leu Lys Phe Leu Ile Thr Gly Val
                645                 650                 655


Phe Asp Ile Val Lys Gly Gln Ile Gln Val Ala Ser Asp Asn Ile Lys
                660                 665                 670


Asp Cys Val Lys Cys Phe Ile Asp Val Val Asn Lys Ala Leu Glu Met
        675                 680                 685
                                22
```

```
Cys Ile Asp Gln Val Thr Ile Ala Gly Ala Lys Leu Arg Ser Leu Asn
    690             695             700

Leu Gly Glu Val Phe Ile Ala Gln Ser Lys Gly Leu Tyr Arg Gln Cys
705             710             715             720

Ile Arg Gly Lys Glu Gln Leu Gln Leu Leu Met Pro Leu Lys Ala Pro
            725             730             735

Lys Glu Val Thr Phe Leu Glu Gly Asp Ser His Asp Thr Val Leu Thr
            740             745             750

Ser Glu Glu Val Val Leu Lys Asn Gly Glu Leu Glu Ala Leu Glu Thr
            755             760             765

Pro Val Asp Ser Phe Thr Asn Gly Ala Ile Val Gly Thr Pro Val Cys
    770             775             780

Val Asn Gly Leu Met Leu Leu Glu Ile Lys Asp Lys Glu Gln Tyr Cys
785             790             795             800

Ala Leu Ser Pro Gly Leu Leu Ala Thr Asn Asn Val Phe Arg Leu Lys
            805             810             815

Gly Gly Ala Pro Ile Lys Gly Val Thr Phe Gly Glu Asp Thr Val Trp
            820             825             830

Glu Val Gln Gly Tyr Lys Asn Val Arg Ile Thr Phe Glu Leu Asp Glu
            835             840             845

Arg Val Asp Lys Val Leu Asn Glu Lys Cys Ser Val Tyr Thr Val Glu
    850             855             860

Ser Gly Thr Glu Val Thr Glu Phe Ala Cys Val Val Ala Glu Ala Val
865             870             875             880

Val Lys Thr Leu Gln Pro Val Ser Asp Leu Leu Thr Asn Met Gly Ile
            885             890             895

Asp Leu Asp Glu Trp Ser Val Ala Thr Phe Tyr Leu Phe Asp Asp Ala
            900             905             910
```

23

```
Gly Glu Glu Asn Phe Ser Ser Arg Met Tyr Cys Ser Phe Tyr Pro Pro
    915                 920                 925


Asp Glu Glu Glu Glu Asp Asp Ala Glu Cys Glu Glu Glu Glu Ile Asp
    930                 935                 940


Glu Thr Cys Glu His Glu Tyr Gly Thr Glu Asp Asp Tyr Gln Gly Leu
945                 950                 955                 960


Pro Leu Glu Phe Gly Ala Ser Ala Glu Thr Val Arg Val Glu Glu Glu
                965                 970                 975


Glu Glu Glu Asp Trp Leu Asp Asp Thr Thr Glu Gln Ser Glu Ile Glu
                980                 985                 990


Pro Glu Pro Glu Pro Thr Pro Glu  Glu Pro Val Asn Gln  Phe Thr Gly
        995                 1000                1005


Tyr Leu  Lys Leu Thr Asp Asn  Val Ala Ile Lys Cys  Val Asp Ile
    1010                1015                1020


Val Lys  Glu Ala Gln Ser Ala  Asn Pro Met Val Ile  Val Asn Ala
    1025                1030                1035


Ala Asn  Ile His Leu Lys His  Gly Gly Gly Val Ala  Gly Ala Leu
    1040                1045                1050


Asn Lys  Ala Thr Asn Gly Ala  Met Gln Lys Glu Ser  Asp Asp Tyr
    1055                1060                1065


Ile Lys  Leu Asn Gly Pro Leu  Thr Val Gly Gly Ser  Cys Leu Leu
    1070                1075                1080


Ser Gly  His Asn Leu Ala Lys  Lys Cys Leu His Val  Val Gly Pro
    1085                1090                1095


Asn Leu  Asn Ala Gly Glu Asp  Ile Gln Leu Leu Lys  Ala Ala Tyr
    1100                1105                1110


Glu Asn  Phe Asn Ser Gln Asp  Ile Leu Leu Ala Pro  Leu Leu Ser
    1115                1120                1125
```

24

```
Ala Gly  Ile Phe Gly Ala Lys  Pro Leu Gln Ser Leu  Gln Val Cys
    1130              1135              1140

Val Gln  Thr Val Arg Thr Gln  Val Tyr Ile Ala Val  Asn Asp Lys
    1145              1150              1155

Ala Leu  Tyr Glu Gln Val Val  Met Asp Tyr Leu Asp  Asn Leu Lys
    1160              1165              1170

Pro Arg  Val Glu Ala Pro Lys  Gln Glu Glu Pro Pro  Asn Thr Glu
    1175              1180              1185

Asp Ser  Lys Thr Glu Glu Lys  Ser Val Val Gln Lys  Pro Val Asp
    1190              1195              1200

Val Lys  Pro Lys Ile Lys Ala  Cys Ile Asp Glu Val  Thr Thr Thr
    1205              1210              1215

Leu Glu  Glu Thr Lys Phe Leu  Thr Asn Lys Leu Leu  Leu Phe Ala
    1220              1225              1230

Asp Ile  Asn Gly Lys Lèu Tyr  His Asp Ser Gln Asn  Met Leu Arg
    1235              1240              1245

Gly Glu  Asp Met Ser Phe Leu  Glu Lys Asp Ala Pro  Tyr Met Val
    1250              1255              1260

Gly Asp  Val Ile Thr Ser Gly  Asp Ile Thr Cys Val  Val Ile Pro
    1265              1270              1275

Ser Lys  Lys Ala Gly Gly Thr  Thr Glu Met Leu Ser  Arg Ala Leu
    1280              1285              1290

Lys Lys  Val Pro Val Asp Glu  Tyr Ile Thr Thr Tyr  Pro Gly Gln
    1295              1300              1305

Gly Cys  Ala Gly Tyr Thr Leu  Glu Glu Ala Lys Thr  Ala Leu Lys
    1310              1315              1320

Lys Cys  Lys Ser Ala Phe Tyr  Val Leu Pro Ser Glu  Ala Pro Asn
    1325              1330              1335

Ala Lys  Glu Glu Ile Leu Gly  Thr Val Ser Trp Asn  Leu Arg Glu
                              25
```

Met Leu Ala His Ala Glu Glu Thr Arg Lys Leu Met Pro Ile Cys
    1355   1360   1365

Met Asp Val Arg Ala Ile Met Ala Thr Ile Gln Arg Lys Tyr Lys
    1370   1375   1380

Gly Ile Lys Ile Gln Glu Gly Ile Val Asp Tyr Gly Val Arg Phe
    1385   1390   1395

Phe Phe Tyr Thr Ser Lys Glu Pro Val Ala Ser Ile Ile Thr Lys
    1400   1405   1410

Leu Asn Ser Leu Asn Glu Pro Leu Val Thr Met Pro Ile Gly Tyr
    1415   1420   1425

Val Thr His Gly Phe Asn Leu Glu Glu Ala Ala Arg Cys Met Arg
    1430   1435   1440

Ser Leu Lys Ala Pro Ala Val Val Ser Val Ser Ser Pro Asp Ala
    1445   1450   1455

Val Thr Thr Tyr Asn Gly Tyr Leu Thr Ser Ser Ser Lys Thr Ser
    1460   1465   1470

Glu Glu His Phe Val Glu Thr Val Ser Leu Ala Gly Ser Tyr Arg
    1475   1480   1485

Asp Trp Ser Tyr Ser Gly Gln Arg Thr Glu Leu Gly Val Glu Phe
    1490   1495   1500

Leu Lys Arg Gly Asp Lys Ile Val Tyr His Thr Leu Glu Ser Pro
    1505   1510   1515

Val Glu Phe His Leu Asp Gly Glu Val Leu Ser Leu Asp Lys Leu
    1520   1525   1530

Lys Ser Leu Leu Ser Leu Arg Glu Val Lys Thr Ile Lys Val Phe
    1535   1540   1545

Thr Thr Val Asp Asn Thr Asn Leu His Thr Gln Leu Val Asp Met
    1550   1555   1560

26

```
Ser Met  Thr Tyr Gly Gln Gln  Phe Gly Pro Thr Tyr  Leu Asp Gly
    1565             1570             1575


Ala Asp  Val Thr Lys Ile Lys  Pro His Val Asn His  Glu Gly Lys
    1580             1585             1590


Thr Phe  Phe Val Leu Pro Ser  Asp Asp Thr Leu Arg  Ser Glu Ala
    1595             1600             1605


Phe Glu  Tyr Tyr His Thr Leu  Asp Glu Ser Phe Leu  Gly Arg Tyr
    1610             1615             1620


Met Ser  Ala Leu Asn His Thr  Lys Lys Trp Lys Phe  Pro Gln Val
    1625             1630             1635


Gly Gly  Leu Thr Ser Ile Lys  Trp Ala Asp Asn Asn  Cys Tyr Leu
    1640             1645             1650


Ser Ser  Val Leu Leu Ala Leu  Gln Gln Leu Glu Val  Lys Phe Asn
    1655             1660             1665


Ala Pro  Ala Leu Gln Glu Ala  Tyr Tyr Arg Ala Arg  Ala Gly Asp
    1670             1675             1680


Ala Ala  Asn Phe Cys Ala Leu  Ile Leu Ala Tyr Ser  Asn Lys Thr
    1685             1690             1695


Val Gly  Glu Leu Gly Asp Val  Arg Glu Thr Met Thr  His Leu Leu
    1700             1705             1710


Gln His  Ala Asn Leu Glu Ser  Ala Lys Arg Val Leu  Asn Val Val
    1715             1720             1725


Cys Lys  His Cys Gly Gln Lys  Thr Thr Thr Leu Thr  Gly Val Glu
    1730             1735             1740


Ala Val  Met Tyr Met Gly Thr  Leu Ser Tyr Asp Asn  Leu Lys Thr
    1745             1750             1755


Gly Val  Ser Ile Pro Cys Val  Cys Gly Arg Asp Ala  Thr Gln Tyr
    1760             1765             1770
```

27

```
Leu Val Gln Gln Glu Ser Ser   Phe Val Met Met Ser   Ala Pro Pro
    1775            1780                1785

Ala Glu Tyr Lys Leu Gln Gln   Gly Thr Phe Leu Cys   Ala Asn Glu
    1790            1795                1800

Tyr Thr Gly Asn Tyr Gln Cys   Gly His Tyr Thr His   Ile Thr Ala
    1805            1810                1815

Lys Glu Thr Leu Tyr Arg Ile   Asp Gly Ala His Leu   Thr Lys Met
    1820            1825                1830

Ser Glu Tyr Lys Gly Pro Val   Thr Asp Val Phe Tyr   Lys Glu Thr
    1835            1840                1845

Ser Tyr Thr Thr Thr Ile Lys   Pro Val Ser Tyr Lys   Leu Asp Gly
    1850            1855                1860

Val Thr Tyr Thr Glu Ile Glu   Pro Lys Leu Asp Gly   Tyr Tyr Lys
    1865            1870                1875

Lys Asp Asn Ala Tyr Tyr Thr   Glu Gln Pro Ile Asp   Leu Val Pro
    1880            1885                1890

Thr Gln Pro Leu Pro Asn Ala   Ser Phe Asp Asn Phe   Lys Leu Thr
    1895            1900                1905

Cys Ser Asn Thr Lys Phe Ala   Asp Asp Leu Asn Gln   Met Thr Gly
    1910            1915                1920

Phe Thr Lys Pro Ala Ser Arg   Glu Leu Ser Val Thr   Phe Phe Pro
    1925            1930                1935

Asp Leu Asn Gly Asp Val Val   Ala Ile Asp Tyr Arg   His Tyr Ser
    1940            1945                1950

Ala Ser Phe Lys Lys Gly Ala   Lys Leu Leu His Lys   Pro Ile Val
    1955            1960                1965

Trp His Ile Asn Gln Ala Thr   Thr Lys Thr Thr Phe   Lys Pro Asn
    1970            1975                1980
```

28

Thr Trp Cys Leu Arg Cys Leu Trp Ser Thr Lys Pro Val Asp Thr
    1985   1990   1995

Ser Asn Ser Phe Glu Val Leu Ala Val Glu Asp Thr Gln Gly Met
    2000   2005   2010

Asp Asn Leu Ala Cys Glu Ser Gln Gln Pro Thr Ser Glu Glu Val
    2015   2020   2025

Val Glu Asn Pro Thr Ile Gln Lys Glu Val Ile Glu Cys Asp Val
    2030   2035   2040

Lys Thr Thr Glu Val Val Gly Asn Val Ile Leu Lys Pro Ser Asp
    2045   2050   2055

Glu Gly Val Lys Val Thr Gln Glu Leu Gly His Glu Asp Leu Met
    2060   2065   2070

Ala Ala Tyr Val Glu Asn Thr Ser Ile Thr Ile Lys Lys Pro Asn
    2075   2080   2085

Glu Leu Ser Leu Ala Leu Gly Leu Lys Thr Ile Ala Thr His Gly
    2090   2095   2100

Ile Ala Ala Ile Asn Ser Val Pro Trp Ser Lys Ile Leu Ala Tyr
    2105   2110   2115

Val Lys Pro Phe Leu Gly Gln Ala Ala Ile Thr Thr Ser Asn Cys
    2120   2125   2130

Ala Lys Arg Leu Ala Gln Arg Val Phe Asn Asn Tyr Met Pro Tyr
    2135   2140   2145

Val Phe Thr Leu Leu Phe Gln Leu Cys Thr Phe Thr Lys Ser Thr
    2150   2155   2160

Asn Ser Arg Ile Arg Ala Ser Leu Pro Thr Thr Ile Ala Lys Asn
    2165   2170   2175

Ser Val Lys Ser Val Ala Lys Leu Cys Leu Asp Ala Gly Ile Asn
    2180   2185   2190

Tyr Val Lys Ser Pro Lys Phe Ser Lys Leu Phe Thr Ile Ala Met

29

```
         2195                  2200                  2205

Trp Leu  Leu Leu Leu Ser Ile  Cys Leu Gly Ser Leu  Ile Cys Val
    2210                 2215                 2220

Thr Ala  Ala Phe Gly Val Leu  Leu Ser Asn Phe Gly  Ala Pro Ser
    2225                 2230                 2235

Tyr Cys  Asn Gly Val Arg Glu  Leu Tyr Leu Asn Ser  Ser Asn Val
    2240                 2245                 2250

Thr Thr  Met Asp Phe Cys Glu  Gly Ser Phe Pro Cys  Ser Ile Cys
    2255                 2260                 2265

Leu Ser  Gly Leu Asp Ser Leu  Asp Ser Tyr Pro Ala  Leu Glu Thr
    2270                 2275                 2280

Ile Gln  Val Thr Ile Ser Ser  Tyr Lys Leu Asp Leu  Thr Ile Leu
    2285                 2290                 2295

Gly Leu  Ala Ala Glu Trp Val  Leu Ala Tyr Met Leu  Phe Thr Lys
    2300                 2305                 2310

Phe Phe  Tyr Leu Leu Gly Leu  Ser Ala Ile Met Gln  Val Phe Phe
    2315                 2320                 2325

Gly Tyr  Phe Ala Ser His Phe  Ile Ser Asn Ser Trp  Leu Met Trp
    2330                 2335                 2340

Phe Ile  Ile Ser Ile Val Gln  Met Ala Pro Val Ser  Ala Met Val
    2345                 2350                 2355

Arg Met  Tyr Ile Phe Phe Ala  Ser Phe Tyr Tyr Ile  Trp Lys Ser
    2360                 2365                 2370

Tyr Val  His Ile Met Asp Gly  Cys Thr Ser Ser Thr  Cys Met Met
    2375                 2380                 2385

Cys Tyr  Lys Arg Asn Arg Ala  Thr Arg Val Glu Cys  Thr Thr Ile
    2390                 2395                 2400

Val Asn  Gly Met Lys Arg Ser  Phe Tyr Val Tyr Ala  Asn Gly Gly
    2405                 2410                 2415
```

30

```
Arg Gly  Phe Cys Lys Thr His  Asn Trp Asn Cys Leu  Asn Cys Asp
    2420             2425             2430

Thr Phe  Cys Thr Gly Ser Thr  Phe Ile Ser Asp Glu  Val Ala Arg
    2435             2440             2445

Asp Leu  Ser Leu Gln Phe Lys  Arg Pro Ile Asn Pro  Thr Asp Gln
    2450             2455             2460

Ser Ser  Tyr Ile Val Asp Ser  Val Ala Val Lys Asn  Gly Ala Leu
    2465             2470             2475

His Leu  Tyr Phe Asp Lys Ala  Gly Gln Lys Thr Tyr  Glu Arg His
    2480             2485             2490

Pro Leu  Ser His Phe Val Asn  Leu Asp Asn Leu Arg  Ala Asn Asn
    2495             2500             2505

Thr Lys  Gly Ser Leu Pro Ile  Asn Val Ile Val Phe  Asp Gly Lys
    2510             2515             2520

Ser Lys  Cys Asp Glu Ser Ala  Ser Lys Ser Ala Ser  Val Tyr Tyr
    2525             2530             2535

Ser Gln  Leu Met Cys Gln Pro  Ile Leu Leu Leu Asp  Gln Val Leu
    2540             2545             2550

Val Ser  Asp Val Gly Asp Ser  Thr Glu Val Ser Val  Lys Met Phe
    2555             2560             2565

Asp Ala  Tyr Val Asp Thr Phe  Ser Ala Thr Phe Ser  Val Pro Met
    2570             2575             2580

Glu Lys  Leu Lys Ala Leu Val  Ala Thr Ala His Ser  Glu Leu Ala
    2585             2590             2595

Lys Gly  Val Ala Leu Asp Gly  Val Leu Ser Thr Phe  Val Ser Ala
    2600             2605             2610

Ala Arg  Gln Gly Val Val Asp  Thr Asp Val Asp Thr  Lys Asp Val
    2615             2620             2625
```

31

Ile Glu Cys Leu Lys Leu Ser His His Ser Asp Leu Glu Val Thr
    2630   2635   2640

Gly Asp Ser Cys Asn Asn Phe Met Leu Thr Tyr Asn Lys Val Glu
    2645   2650   2655

Asn Met Thr Pro Arg Asp Leu Gly Ala Cys Ile Asp Cys Asn Ala
    2660   2665   2670

Arg His Ile Asn Ala Gln Val Ala Lys Ser His Asn Val Ser Leu
    2675   2680   2685

Ile Trp Asn Val Lys Asp Tyr Met Ser Leu Ser Glu Gln Leu Arg
    2690   2695   2700

Lys Gln Ile Arg Ser Ala Ala Lys Lys Asn Asn Ile Pro Phe Arg
    2705   2710   2715

Leu Thr Cys Ala Thr Thr Arg Gln Val Val Asn Val Ile Thr Thr
    2720   2725   2730

Lys Ile Ser Leu Lys Gly Gly Lys Ile Val Ser Thr Cys Phe Lys
    2735   2740   2745

Leu Met Leu Lys Ala Thr Leu Leu Cys Val Leu Ala Ala Leu Val
    2750   2755   2760

Cys Tyr Ile Val Met Pro Val His Thr Leu Ser Ile His Asp Gly
    2765   2770   2775

Tyr Thr Asn Glu Ile Ile Gly Tyr Lys Ala Ile Gln Asp Gly Val
    2780   2785   2790

Thr Arg Asp Ile Ile Ser Thr Asp Asp Cys Phe Ala Asn Lys His
    2795   2800   2805

Ala Gly Phe Asp Ala Trp Phe Ser Gln Arg Gly Gly Ser Tyr Lys
    2810   2815   2820

Asn Asp Lys Ser Cys Pro Val Val Ala Ala Ile Ile Thr Arg Glu
    2825   2830   2835

32

```
Ile Gly  Phe Ile Val Pro Gly  Leu Pro Gly Thr Val  Leu Arg Ala
    2840              2845          2850

Ile Asn  Gly Asp Phe Leu His  Phe Leu Pro Arg Val  Phe Ser Ala
    2855              2860          2865

Val Gly  Asn Ile Cys Tyr Thr  Pro Ser Lys Leu Ile  Glu Tyr Ser
    2870              2875          2880

Asp Phe  Ala Thr Ser Ala Cys  Val Leu Ala Ala Glu  Cys Thr Ile
    2885              2890          2895

Phe Lys  Asp Ala Met Gly Lys  Pro Val Pro Tyr Cys  Tyr Asp Thr
    2900              2905          2910

Asn Leu  Leu Glu Gly Ser Ile  Ser Tyr Ser Glu Leu  Arg Pro Asp        2915
2920              2925

Thr Arg  Tyr Val Leu Met Asp  Gly Ser Ile Ile Gln  Phe Pro Asn
    2930              2935          2940

Thr Tyr  Leu Glu Gly Ser Val  Arg Val Val Thr Thr  Phe Asp Ala
    2945              2950          2955

Glu Tyr  Cys Arg His Gly Thr  Cys Glu Arg Ser Glu  Val Gly Ile
    2960              2965          2970

Cys Leu  Ser Thr Ser Gly Arg  Trp Val Leu Asn Asn  Glu His Tyr
    2975              2980          2985

Arg Ala  Leu Ser Gly Val Phe  Cys Gly Val Asp Ala  Met Asn Leu
    2990              2995          3000

Ile Ala  Asn Ile Phe Thr Pro  Leu Val Gln Pro Val  Gly Ala Leu
    3005              3010          3015

Asp Val  Ser Ala Ser Val Val  Ala Gly Gly Ile Ile  Ala Ile Leu
    3020                  3025          3030

Val Thr  Cys Ala Ala Tyr Tyr  Phe Met Lys Phe Arg  Arg Val Phe
    3035              3040          3045

Gly Glu  Tyr Asn His Val Val  Ala Ala Asn Ala Leu  Leu Phe Leu
```

33

```
            3050                    3055                    3060


Met Ser  Phe Thr Ile Leu Cys  Leu Val Pro Ala Tyr  Ser Phe Leu
    3065                 3070                 3075


Pro Gly  Val Tyr Ser Val Phe  Tyr Leu Tyr Leu Thr  Phe Tyr Phe
    3080                 3085                 3090


Thr Asn  Asp Val Ser Phe Leu  Ala His Leu Gln Trp  Phe Ala Met
    3095                 3100                 3105


Phe Ser  Pro Ile Val Pro Phe  Trp Ile Thr Ala Ile  Tyr Val Phe
    3110                 3115                 3120


Cys Ile  Ser Leu Lys His Cys  His Trp Phe Phe Asn  Asn Tyr Leu
    3125                 3130                 3135


Arg Lys  Arg Val Met Phe Asn  Gly Val Thr Phe Ser  Thr Phe Glu
    3140                 3145                 3150


Glu Ala  Ala Leu Cys Thr Phe  Leu Leu Asn Lys Glu  Met Tyr Leu
    3155                 3160                 3165


Lys Leu  Arg Ser Glu Thr Leu  Leu Pro Leu Thr Gln  Tyr Asn Arg
    3170                 3175                 3180


Tyr Leu  Ala Leu Tyr Asn Lys  Tyr Lys Tyr Phe Ser  Gly Ala Leu
    3185                 3190                 3195


Asp Thr  Thr Ser Tyr Arg Glu  Ala Ala Cys Cys His  Leu Ala Lys
    3200                 3205                 3210


Ala Leu  Asn Asp Phe Ser Asn  Ser Gly Ala Asp Val  Leu Tyr Gln
    3215                 3220                 3225


Pro Pro  Gln Thr Ser Ile Thr  Ser Ala Val Leu Gln  Ser Gly Phe
    3230                 3235                 3240


Arg Lys  Met Ala Phe Pro Ser  Gly Lys Val Glu Gly  Cys Met Val
    3245                 3250                 3255


Gln Val  Thr Cys Gly Thr Thr  Thr Leu Asn Gly Leu  Trp Leu Asp
    3260                 3265                 3270
```

34

```
Asp Thr  Val Tyr Cys Pro Arg  His Val Ile Cys Thr  Ala Glu Asp
    3275             3280         3285

Met Leu  Asn Pro Asn Tyr Glu  Asp Leu Leu Ile Arg  Lys Ser Asn
    3290             3295         3300

His Ser  Phe Leu Val Gln Ala  Gly Asn Val Gln Leu  Arg Val Ile
    3305             3310         3315

Gly His  Ser Met Gln Asn Cys  Leu Leu Arg Leu Lys  Val Asp Thr
    3320             3325         3330

Ser Asn  Pro Lys Thr Pro Lys  Tyr Lys Phe Val Arg  Ile Gln Pro
    3335             3340         3345

Gly Gln  Thr Phe Ser Val Leu  Ala Cys Tyr Asn Gly  Ser Pro Ser
    3350             3355         3360

Gly Val  Tyr Gln Cys Ala Met  Arg Pro Asn His Thr  Ile Lys Gly
    3365             3370         3375

Ser Phe  Leu Asn Gly Ser Cys  Gly Ser Val Gly Phe  Asn Ile Asp
    3380             3385         3390

Tyr Asp  Cys Val Ser Phe Cys  Tyr Met His His Met  Glu Leu Pro
    3395             3400         3405

Thr Gly  Val His Ala Gly Thr  Asp Leu Glu Gly Lys  Phe Tyr Gly
    3410             3415         3420

Pro Phe  Val Asp Arg Gln Thr  Ala Gln Ala Ala Gly  Thr Asp Thr
    3425             3430         3435

Thr Ile  Thr Leu Asn Val Leu  Ala Trp Leu Tyr Ala  Ala Val Ile
    3440             3445         3450

Asn Gly  Asp Arg Trp Phe Leu  Asn Arg Phe Thr Thr  Thr Leu Asn
    3455             3460         3465

Asp Phe  Asn Leu Val Ala Met  Lys Tyr Asn Tyr Glu  Pro Leu Thr
    3470             3475         3480
```

35

```
Gln Asp  His Val Asp Ile Leu  Gly Pro Leu Ser Ala  Gln Thr Gly
    3485              3490              3495

Ile Ala  Val Leu Asp Met Cys  Ala Ala Leu Lys Glu  Leu Leu Gln
    3500              3505              3510

Asn Gly  Met Asn Gly Arg Thr  Ile Leu Gly Ser Thr  Ile Leu Glu
    3515              3520              3525

Asp Glu  Phe Thr Pro Phe Asp  Val Val Arg Gln Cys  Ser Gly Val
    3530              3535              3540

Thr Phe  Gln Gly Lys Phe Lys  Lys Ile Val Lys Gly  Thr His His
    3545              3550              3555

Trp Met  Leu Leu Thr Phe Leu  Thr Ser Leu Leu Ile  Leu Val Gln
    3560              3565              3570

Ser Thr  Gln Trp Ser Leu Phe  Phe Phe Val Tyr Glu  Asn Ala Phe
    3575              3580              3585

Leu Pro  Phe Thr Leu Gly Ile  Met Ala Ile Ala Ala  Cys Ala Met
    3590            · 3595              3600

Leu Leu  Val Lys His Lys His  Ala Phe Leu Cys Leu  Phe Leu Leu
    3605              3610              3615

Pro Ser  Leu Ala Thr Val Ala  Tyr Phe Asn Met Val  Tyr Met Pro
    3620              3625              3630

Ala Ser  Trp Val Met Arg Ile  Met Thr Trp Leu Glu  Leu Ala Asp
    3635              3640              3645

Thr Ser  Leu Ser Gly Tyr Arg  Leu Lys Asp Cys Val  Met Tyr Ala
    3650              3655              3660

Ser Ala  Leu Val Leu Leu Ile  Leu Met Thr Ala Arg  Thr Val Tyr
    3665              3670              3675

Asp Asp  Ala Ala Arg Arg Val  Trp Thr Leu Met Asn  Val Ile Thr
    3680              3685              3690
```

36

Leu Val Tyr Lys Val Tyr Tyr Gly Asn Ala Leu Asp Gln Ala Ile
    3695   3700   3705

Ser Met Trp Ala Leu Val Ile Ser Val Thr Ser Asn Tyr Ser Gly
    3710   3715   3720

Val Val Thr Thr Ile Met Phe Leu Ala Arg Ala Ile Val Phe Val
    3725   3730   3735

Cys Val Glu Tyr Tyr Pro Leu Leu Phe Ile Thr Gly Asn Thr Leu
    3740   3745   3750

Gln Cys Ile Met Leu Val Tyr Cys Phe Leu Gly Tyr Cys Cys Cys
    3755   3760   3765

Cys Tyr Phe Gly Leu Phe Cys Leu Leu Asn Arg Tyr Phe Arg Leu
    3770   3775   3780

Thr Leu Gly Val Tyr Asp Tyr Leu Val Ser Thr Gln Glu Phe Arg
    3785   3790   3795

Tyr Met Asn Ser Gln Gly Leu Leu Pro Pro Lys Ser Ser Ile Asp
    3800   3805   3810

Ala Phe Lys Leu Asn Ile Lys Leu Leu Gly Ile Gly Gly Lys Pro
    3815   3820   3825

Cys Ile Lys Val Ala Thr Val Gln Ser Lys Met Ser Asp Val Lys
    3830   3835   3840

Cys Thr Ser Val Val Leu Leu Ser Val Leu Gln Gln Leu Arg Val
    3845   3850   3855

Glu Ser Ser Ser Lys Leu Trp Ala Gln Cys Val Gln Leu His Asn
    3860   3865   3870

Asp Ile Leu Leu Ala Lys Asp Thr Thr Glu Ala Phe Glu Lys Met
    3875   3880   3885

Val Ser Leu Leu Ser Val Leu Leu Ser Met Gln Gly Ala Val Asp
    3890   3895   3900

Ile Asn Arg Leu Cys Glu Glu Met Leu Asp Asn Arg Ala Thr Leu

37

```
          3905                    3910                    3915


Gln Ala  Ile Ala Ser Glu Phe  Ser Ser Leu Pro Ser  Tyr Ala Ala
     3920                 3925                 3930


Tyr Ala  Thr Ala Gln Glu Ala  Tyr Glu Gln Ala Val  Ala Asn Gly
     3935                 3940                 3945


Asp Ser  Glu Val Val Leu Lys  Lys Leu Lys Lys Ser  Leu Asn Val
     3950                 3955                 3960


Ala Lys  Ser Glu Phe Asp Arg  Asp Ala Ala Met Gln · Arg Lys Leu
     3965                 3970                 3975


Glu Lys  Met Ala Asp Gln Ala  Met Thr Gln Met Tyr  Lys Gln Ala
     3980                 3985                 3990


Arg Ser  Glu Asp Lys Arg Ala  Lys Val Thr Ser Ala  Met Gln Thr
     3995                 4000                 4005


Met Leu  Phe Thr Met Leu Arg  Lys Leu Asp Asn Asp  Ala Leu Asn
     4010                 4015                 4020


Asn Ile  Ile Asn Asn Ala Arg  Asp Gly Cys Val Pro  Leu Asn Ile
     4025                 4030                 4035


Ile Pro  Leu Thr Thr Ala Ala  Lys Leu Met Val Val  Val Pro Asp
     4040                 4045                 4050


Tyr Gly  Thr Tyr Lys Asn Thr  Cys Asp Gly Asn Thr  Phe Thr Tyr
     4055                 4060                 4065


Ala Ser  Ala Leu Trp Glu Ile  Gln Gln Val Val Asp  Ala Asp Ser
     4070                 4075                 4080


Lys Ile  Val Gln Leu Ser Glu  Ile Asn Met Asp Asn  Ser Pro Asn
     4085                 4090                 4095


Leu Ala  Trp Pro Leu Ile Val  Thr Ala Leu Arg Ala  Asn Ser Ala
     4100                 4105                 4110


Val Lys  Leu Gln Asn Asn Glu  Leu Ser Pro Val Ala  Leu Arg Gln
     4115                 4120                 4125
                              38
```

```
Met Ser  Cys Ala Ala Gly Thr  Thr Gln Thr Ala Cys  Thr Asp Asp
    4130              4135              4140


Asn Ala  Leu Ala Tyr Tyr Asn  Asn Ser Lys Gly Gly  Arg Phe Val
    4145              4150              4155


Leu Ala  Leu Leu Ser Asp His  Gln Asp Leu Lys Trp  Ala Arg Phe
    4160              4165              4170


Pro Lys  Ser Asp Gly Thr Gly  Thr Ile Tyr Thr Glu  Leu Glu Pro
    4175              4180              4185


Pro Cys  Arg Phe Val Thr Asp  Thr Pro Lys Gly Pro  Lys Val Lys
    4190              4195              4200


                                    .
Tyr Leu  Tyr Phe Ile Lys Gly  Leu Asn Asn Leu Asn  Arg Gly Met
    4205              4210              4215


Val Leu  Gly Ser Leu Ala Ala  Thr Val Arg Leu Gln  Ala Gly Asn
    4220              4225              4230


Ala Thr  Glu Val Pro Ala Asn  Ser Thr Val Leu Ser  Phe Cys Ala
    4235              4240              4245


Phe Ala  Val Asp Pro Ala Lys  Ala Tyr Lys Asp Tyr  Leu Ala Ser
    4250              4255              4260


Gly Gly  Gln Pro Ile Thr Asn  Cys Val Lys Met Leu  Cys Thr His
    4265              4270              4275


Thr Gly  Thr Gly Gln Ala Ile  Thr Val Thr Pro Glu  Ala Asn Met
    4280              4285              4290


Asp Gln  Glu Ser Phe Gly Gly  Ala Ser Cys Cys Leu  Tyr Cys Arg
    4295              4300              4305


Cys His  Ile Asp His Pro Asn  Pro Lys Gly Phe Cys  Asp Leu Lys
    4310              4315              4320


Gly Lys  Tyr Val Gln Ile Pro  Thr Thr Cys Ala Asn  Asp Pro Val
    4325              4330              4335
```

39

Gly Phe Thr Leu Arg Asn Thr Val Cys Thr Val Cys Gly Met Trp
    4340   4345   4350

Lys Gly Tyr Gly Cys Ser Cys Asp Gln Leu Arg Glu Pro Leu Met
    4355   4360   4365

Gln Ser Ala Asp Ala Ser Thr Phe Leu Asn Gly Phe Ala Val
    4370   4375   4380

<210> 3
<211> 2695
<212> PRT
<213> Coronavirus

<400> 3

Arg Val Cys Gly Val Ser Ala Ala Arg Leu Thr Pro Cys Gly Thr Gly
1   5   10   15

Thr Ser Thr Asp Val Val Tyr Arg Ala Phe Asp Ile Tyr Asn Glu Lys
            20   25   30

Val Ala Gly Phe Ala Lys Phe Leu Lys Thr Asn Cys Cys Arg Phe Gln
            35   40   45

Glu Lys Asp Glu Glu Gly Asn Leu Leu Asp Ser Tyr Phe Val Val Lys
    50   55   60

Arg His Thr Met Ser Asn Tyr Gln His Glu Glu Thr Ile Tyr Asn Leu
65   70   75   80

Val Lys Asp Cys Pro Ala Val Ala Val His Asp Phe Phe Lys Phe Arg
            85   90   95

Val Asp Gly Asp Met Val Pro His Ile Ser Arg Gln Arg Leu Thr Lys
            100   105   110

Tyr Thr Met Ala Asp Leu Val Tyr Ala Leu Arg His Phe Asp Glu Gly
            115   120   125

Asn Cys Asp Thr Leu Lys Glu Ile Leu Val Thr Tyr Asn Cys Cys Asp
    130   135   140

Asp Asp Tyr Phe Asn Lys Lys Asp Trp Tyr Asp Phe Val Glu Asn Pro
145   150   155   160

40

Asp Ile Leu Arg Val Tyr Ala Asn Leu Gly Glu Arg Val Arg Gln Ser
            165   170   175

Leu Leu Lys Thr Val Gln Phe Cys Asp Ala Met Arg Asp Ala Gly Ile
            180   185   190

Val Gly Val Leu Thr Leu Asp Asn Gln Asp Leu Asn Gly Asn Trp Tyr
            195   200   205

Asp Phe Gly Asp Phe Val Gln Val Ala Pro Gly Cys Gly Val Pro Ile
      210   215   220

Val Asp Ser Tyr Tyr Ser Leu Leu Met Pro Ile Leu Thr Leu Thr Arg
225   230   235   240

Ala Leu Ala Ala Glu Ser His Met Asp Ala Asp Leu Ala Lys Pro Leu
            245   250   255

Ile Lys Trp Asp Leu Leu Lys Tyr Asp Phe Thr Glu Glu Arg Leu Cys
            260   265   270

Leu Phe Asp Arg Tyr Phe Lys Tyr Trp Asp Gln Thr Tyr His Pro Asn
            275   280   285

Cys Ile Asn Cys Leu Asp Asp Arg Cys Ile Leu His Cys Ala Asn Phe
      290   295   300

Asn Val Leu Phe Ser Thr Val Phe Pro Pro Thr Ser Phe Gly Pro Leu
305   310   315   320

Val Arg Lys Ile Phe Val Asp Gly Val Pro Phe Val Val Ser Thr Gly
            325   330   335

Tyr His Phe Arg Glu Leu Gly Val Val His Asn Gln Asp Val Asn Leu
            340   345   350

His Ser Ser Arg Leu Ser Phe Lys Glu Leu Leu Val Tyr Ala Ala Asp
            355   360   365

Pro Ala Met His Ala Ala Ser Gly Asn Leu Leu Leu Asp Lys Arg Thr
      370   375   380

41

```
Thr Cys Phe Ser Val Ala Ala Leu Thr Asn Asn Val Ala Phe Gln Thr
385             390         395             400

Val Lys Pro Gly Asn Phe Asn Lys Asp Phe Tyr Asp Phe Ala Val Ser
            405             410             415

Lys Gly Phe Phe Lys Glu Gly Ser Ser Val Glu Leu Lys His Phe Phe
            420             425             430

Phe Ala Gln Asp Gly Asn Ala Ala Ile Ser Asp Tyr Asp Tyr Tyr Arg
        435             440             445

Tyr Asn Leu Pro Thr Met Cys Asp Ile Arg Gln Leu Leu Phe Val Val
    450             455             460

Glu Val Val Asp Lys Tyr Phe Asp Cys Tyr Asp Gly Gly Cys Ile Asn
465             470             475                 480

Ala Asn Gln Val Ile Val Asn Asn Leu Asp Lys Ser Ala Gly Phe Pro
            485             490             495

Phe Asn Lys Trp Gly Lys Ala Arg Leu Tyr Tyr Asp Ser Met Ser Tyr
            500             505             510

Glu Asp Gln Asp Ala Leu Phe Ala Tyr Thr Lys Arg Asn Val Ile Pro
        515             520             525

Thr Ile Thr Gln Met Asn Leu Lys Tyr Ala Ile Ser Ala Lys Asn Arg
    530             535             540

Ala Arg Thr Val Ala Gly Val Ser Ile Cys Ser Thr Met Thr Asn Arg
545             550             555             560

Gln Phe His Gln Lys Leu Leu Lys Ser Ile Ala Ala Thr Arg Gly Ala
            565             570             575

Thr Val Val Ile Gly Thr Ser Lys Phe Tyr Gly Gly Trp His Asn Met
            580             585             590

Leu Lys Thr Val Tyr Ser Asp Val Glu Thr Pro His Leu Met Gly Trp
            595             600             605
```

```
Asp Tyr Pro Lys Cys Asp Arg Ala Met Pro Asn Met Leu Arg Ile Met
    610             615             620

Ala Ser Leu Val Leu Ala Arg Lys His Asn Thr Cys Cys Asn Leu Ser
625             630             635                     640

His Arg Phe Tyr Arg Leu Ala Asn Glu Cys Ala Gln Val Leu Ser Glu
            645             650                     655

Met Val Met Cys Gly Gly Ser Leu Tyr Val Lys Pro Gly Gly Thr Ser
            660             665             670

Ser Gly Asp Ala Thr Thr Ala Tyr Ala Asn Ser Val Phe Asn Ile Cys
        675             680             685

Gln Ala Val Thr Ala Asn Val Asn Ala Leu Leu Ser Thr Asp Gly Asn
    690             695             700

Lys Ile Ala Asp Lys Tyr Val Arg Asn Leu Gln His Arg Leu Tyr Glu
705             710             715                     720

Cys Leu Tyr Arg Asn Arg Asp Val Asp His Glu Phe Val Asp Glu Phe
            725             730             735

Tyr Ala Tyr Leu Arg Lys His Phe Ser Met Met Ile Leu Ser Asp Asp
            740             745             750

Ala Val Val Cys Tyr Asn Ser Asn Tyr Ala Ala Gln Gly Leu Val Ala
        755             760             765

Ser Ile Lys Asn Phe Lys Ala Val Leu Tyr Tyr Gln Asn Asn Val Phe
    770             775             780

Met Ser Glu Ala Lys Cys Trp Thr Glu Thr Asp Leu Thr Lys Gly Pro
785             790             795                     800

His Glu Phe Cys Ser Gln His Thr Met Leu Val Lys Gln Gly Asp Asp
            805             810             815

Tyr Val Tyr Leu Pro Tyr Pro Asp Pro Ser Arg Ile Leu Gly Ala Gly
            820             825             830

Cys Phe Val Asp Asp Ile Val Lys Thr Asp Gly Thr Leu Met Ile Glu
        835             840             845

                            43
```

```
Arg Phe Val Ser Leu Ala Ile Asp Ala Tyr Pro Leu Thr Lys His Pro
    850             855             860

Asn Gln Glu Tyr Ala Asp Val Phe His Leu Tyr Leu Gln Tyr Ile Arg
865             870             875             880

Lys Leu His Asp Glu Leu Thr Gly His Met Leu Asp Met Tyr Ser Val
                885             890             895

Met Leu Thr Asn Asp Asn Thr Ser Arg Tyr Trp Glu Pro Glu Phe Tyr
                900             905             910

Glu Ala Met Tyr Thr Pro His Thr Val Leu Gln Ala Val Gly Ala Cys
        915             920             925

Val Leu Cys Asn Ser Gln Thr Ser Leu Arg Cys Gly Ala Cys Ile Arg
    930             935             940

Arg Pro Phe Leu Cys Cys Lys Cys Cys Tyr Asp His Val Ile Ser Thr
945             950             955             960

Ser His Lys Leu Val Leu Ser Val Asn Pro Tyr Val Cys Asn Ala Pro
                965             970             975

Gly Cys Asp Val Thr Asp Val Thr Gln Leu Tyr Leu Gly Gly Met Ser
                980             985             990

Tyr Tyr Cys Lys Ser His Lys Pro  Pro Ile Ser Phe Pro  Leu Cys Ala
        995             1000            1005

Asn Gly  Gln Val Phe Gly Leu  Tyr Lys Asn Thr Cys  Val Gly Ser
    1010            1015            1020

Asp Asn  Val Thr Asp Phe Asn  Ala Ile Ala Thr Cys  Asp Trp Thr
    1025            1030            1035

Asn Ala  Gly Asp Tyr Ile Leu  Ala Asn Thr Cys Thr  Glu Arg Leu
    1040            1045            1050

Lys Leu  Phe Ala Ala Glu Thr  Leu Lys Ala Thr Glu  Glu Thr Phe
    1055            1060            1065
```

44

Lys Leu Ser Tyr Gly Ile Ala Thr Val Arg Glu Val Leu Ser Asp
    1070   1075   1080

Arg Glu Leu His Leu Ser Trp Glu Val Gly Lys Pro Arg Pro Pro
    1085   1090   1095

Leu Asn Arg Asn Tyr Val Phe Thr Gly Tyr Arg Val Thr Lys Asn
    1100   1105   1110

Ser Lys Val Gln Ile Gly Glu Tyr Thr Phe Glu Lys Gly Asp Tyr
    1115   1120   1125

Gly Asp Ala Val Val Tyr Arg Gly Thr Thr Thr Tyr Lys Leu Asn
    1130   1135   1140

Val Gly Asp Tyr Phe Val Leu Thr Ser His Thr Val Met Pro Leu
    1145   1150   1155

Ser Ala Pro Thr Leu Val Pro Gln Glu His Tyr Val Arg Ile Thr
    1160   1165   1170

Gly Leu Tyr Pro Thr Leu Asn Ile Ser Asp Glu Phe Ser Ser Asn
    1175   1180   1185

Val Ala Asn Tyr Gln Lys Val Gly Met Gln Lys Tyr Ser Thr Leu
    1190   1195   1200

Gln Gly Pro Pro Gly Thr Gly Lys Ser His Phe Ala Ile Gly Leu
    1205   1210   1215

Ala Leu Tyr Tyr Pro Ser Ala Arg Ile Val Tyr Thr Ala Cys Ser
    1220   1225   1230

His Ala Ala Val Asp Ala Leu Cys Glu Lys Ala Leu Lys Tyr Leu
    1235   1240   1245

Pro Ile Asp Lys Cys Ser Arg Ile Ile Pro Ala Arg Ala Arg Val
    1250   1255   1260

Glu Cys Phe Asp Lys Phe Lys Val Asn Ser Thr Leu Glu Gln Tyr
    1265   1270   1275

Val Phe Cys Thr Val Asn Ala Leu Pro Glu Thr Thr Ala Asp Ile

45

```
          1280                    1285                     1290


     Val Val  Phe Asp Glu Ile Ser  Met Ala Thr Asn Tyr  Asp Leu Ser
         1295                    1300                     1305


     Val Val  Asn Ala Arg Leu Arg  Ala Lys His Tyr Val  Tyr Ile Gly
         1310                    1315                     1320


     Asp Pro  Ala Gln Leu Pro Ala  Pro Arg Thr Leu Leu  Thr Lys Gly
         1325                    1330                     1335


     Thr Leu  Glu Pro Glu Tyr Phe  Asn Ser Val Cys Arg  Leu Met Lys
         1340                    1345                     1350


     Thr Ile  Gly Pro Asp Met Phe  Leu Gly Thr Cys Arg  Arg Cys Pro
         1355                    1360                     1365


     Ala Glu  Ile Val Asp Thr Val  Ser Ala Leu Val Tyr  Asp Asn Lys
         1370                    1375                     1380


     Leu Lys  Ala His Lys Asp Lys  Ser Ala Gln Cys Phe  Lys Met Phe
         1385                    1390                     1395


     Tyr Lys  Gly Val Ile Thr His  Asp Val Ser Ser Ala  Ile Asn Arg
         1400                    1405                     1410


     Pro Gln  Ile Gly Val Val Arg  Glu Phe Leu Thr Arg  Asn Pro Ala
         1415                    1420                     1425
         .

     Trp Arg  Lys Ala Val Phe Ile  Ser Pro Tyr Asn Ser  Gln Asn Ala
         1430                    1435                     1440

 .
     Val Ala  Ser Lys Ile Leu Gly  Leu Pro Thr Gln Thr  Val Asp Ser
         1445                    1450                     1455


     Ser Gln  Gly Ser Glu Tyr Asp  Tyr Val Ile Phe Thr  Gln Thr Thr
         1460                    1465                     1470


     Glu Thr  Ala His Ser Cys Asn  Val Asn Arg Phe Asn  Val Ala Ile
         1475                    1480                     1485


     Thr Arg  Ala Lys Ile Gly Ile  Leu Cys Ile Met Ser  Asp Arg Asp
         1490                    1495                     1500
                                 46
```

Leu Tyr Asp Lys Leu Gln Phe Thr Ser Leu Glu Ile Pro Arg Arg
    1505   1510   1515

Asn Val Ala Thr Leu Gln Ala Glu Asn Val Thr Gly Leu Phe Lys
    1520   1525   1530

Asp Cys Ser Lys Ile Ile Thr Gly Leu His Pro Thr Gln Ala Pro
    1535   1540   1545

Thr His Leu Ser Val Asp Ile Lys Phe Lys Thr Glu Gly Leu Cys
    1550   1555   1560

Val Asp Ile Pro Gly Ile Pro Lys Asp Met Thr Tyr Arg Arg Leu
    1565   1570   1575

Ile Ser Met Met Gly Phe Lys Met Asn Tyr Gln Val Asn Gly Tyr
    1580   1585   1590

Pro Asn Met Phe Ile Thr Arg Glu Glu Ala Ile Arg His Val Arg
    1595   1600   1605

Ala Trp Ile Gly Phe Asp Val Glu Gly Cys His Ala Thr Arg Asp
    1610   1615   1620

Ala Val Gly Thr Asn Leu Pro Leu Gln Leu Gly Phe Ser Thr Gly
    1625   1630   1635

Val Asn Leu Val Ala Val Pro Thr Gly Tyr Val Asp Thr Glu Asn
    1640   1645   1650

Asn Thr Glu Phe Thr Arg Val Asn Ala Lys Pro Pro Pro Gly Asp
    1655   1660   1665

Gln Phe Lys His Leu Ile Pro Leu Met Tyr Lys Gly Leu Pro Trp
    1670   1675   1680

Asn Val Val Arg Ile Lys Ile Val Gln Met Leu Ser Asp Thr Leu
    1685   1690   1695

Lys Gly Leu Ser Asp Arg Val Val Phe Val Leu Trp Ala His Gly
    1700   1705   1710

47

```
Phe Glu  Leu Thr Ser Met Lys  Tyr Phe Val Lys Ile  Gly Pro Glu
    1715             1720             1725


Arg Thr  Cys Cys Leu Cys Asp  Lys Arg Ala Thr Cys  Phe Ser Thr
    1730             1735             1740


Ser Ser  Asp Thr Tyr Ala Cys  Trp Asn His Ser Val  Gly Phe Asp
    1745             1750             1755


Tyr Val  Tyr Asn Pro Phe Met  Ile Asp Val Gln Gln  Trp Gly Phe
    1760             1765             1770


Thr Gly  Asn Leu Gln Ser Asn  His Asp Gln His Cys  Gln Val His
    1775             1780             1785


Gly Asn  Ala His Val Ala Ser  Cys Asp Ala Ile Met  Thr Arg Cys
    1790             1795             1800


Leu Ala  Val His Glu Cys Phe  Val Lys Arg Val Asp  Trp Ser Val
    1805             1810             1815


Glu Tyr  Pro Ile Ile Gly Asp  Glu Leu Arg Val Asn  Ser Ala Cys
    1820             1825             1830


Arg Lys  Val Gln His Met Val  Val Lys Ser Ala Leu  Leu Ala Asp
    1835             1840             1845


Lys Phe  Pro Val Leu His Asp  Ile Gly Asn Pro Lys  Ala Ile Lys
    1850             1855             1860


Cys Val  Pro Gln Ala Glu Val  Glu Trp Lys Phe Tyr  Asp Ala Gln
    1865             1870             1875


Pro Cys  Ser Asp Lys Ala Tyr  Lys Ile Glu Glu Leu  Phe Tyr Ser
    1880             1885             1890


Tyr Ala  Thr His His Asp Lys  Phe Thr Asp Gly Val  Cys Leu Phe
    1895             1900             1905


Trp Asn  Cys Asn Val Asp Arg  Tyr Pro Ala Asn Ala  Ile Val Cys
    1910             1915             1920
```

```
Arg Phe  Asp Thr Arg Val Leu  Ser Asn Leu Asn Leu  Pro Gly Cys
    1925                1930             1935

Asp Gly  Gly Ser Leu Tyr Val  Asn Lys His Ala Phe  His Thr Pro
    1940                1945             1950

Ala Phe  Asp Lys Ser Ala Phe  Thr Asn Leu Lys Gln  Leu Pro Phe
    1955                1960             1965

Phe Tyr  Tyr Ser Asp Ser Pro  Cys Glu Ser His Gly  Lys Gln Val
    1970                1975             1980

Val Ser  Asp Ile Asp Tyr Val  Pro Leu Lys Ser Ala  Thr Cys Ile
    1985                1990             1995

Thr Arg  Cys Asn Leu Gly Gly  Ala Val Cys Arg His  His Ala Asn
    2000                2005             2010

Glu Tyr  Arg Gln Tyr Leu Asp  Ala Tyr Asn Met Met  Ile Ser Ala
    2015                2020             2025

Gly Phe  Ser Leu Trp Ile Tyr  Lys Gln Phe Asp Thr  Tyr Asn Leu
    2030                2035             2040

Trp Asn  Thr Phe Thr Arg Leu  Gln Ser Leu Glu Asn  Val Ala Tyr
    2045                2050             2055

Asn Val  Val Asn Lys Gly His  Phe Asp Gly His Ala  Gly Glu Ala
    2060                2065             2070

Pro Val  Ser Ile Ile Asn Asn  Ala Val Tyr Thr Lys  Val Asp Gly
    2075                2080             2085

Ile Asp  Val Glu Ile Phe Glu  Asn Lys Thr Thr Leu  Pro Val Asn
    2090                2095             2100

Val Ala  Phe Glu Leu Trp Ala  Lys Arg Asn Ile Lys  Pro Val Pro
    2105                2110             2115

Glu Ile  Lys Ile Leu Asn Asn  Leu Gly Val Asp Ile  Ala Ala Asn
    2120                2125             2130

Thr Val  Ile Trp Asp Tyr Lys  Arg Glu Ala Pro Ala  His Val Ser
```

49

```
              2135                    2140                    2145


Thr Ile  Gly Val Cys Thr Met  Thr Asp Ile Ala Lys  Lys Pro Thr
         2150                    2155                    2160


Glu Ser  Ala Cys Ser Ser Leu  Thr Val Leu Phe Asp  Gly Arg Val
         2165                    2170                    2175


Glu Gly  Gln Val Asp Leu Phe  Arg Asn Ala Arg Asn  Gly Val Leu
         2180                    2185                    2190


Ile Thr  Glu Gly Ser Val Lys  Gly Leu Thr Pro Ser  Lys Gly Pro
         2195                    2200                    2205


Ala Gln  Ala Ser Val Asn Gly  Val Thr Leu Ile Gly  Glu Ser Val
         2210                    2215                    2220


Lys Thr  Gln Phe Asn Tyr Phe  Lys Lys Val Asp Gly  Ile Ile Gln
         2225                    2230                    2235


Gln Leu  Pro Glu Thr Tyr Phe  Thr Gln Ser Arg Asp  Leu Glu Asp
         2240                    2245                    2250


Phe Lys  Pro Arg Ser Gln Met  Glu Thr Asp Phe Leu  Glu Leu Ala
         2255                    2260                    2265


Met Asp  Glu Phe Ile Gln Arg  Tyr Lys Leu Glu Gly  Tyr Ala Phe
         2270                    2275                    2280


Glu His  Ile Val Tyr Gly Asp  Phe Ser His Gly Gln  Leu Gly Gly
         2285                    2290                    2295


Leu His  Leu Met Ile Gly Leu  Ala Lys Arg Ser Gln  Asp Ser Pro
         2300                    2305                    2310


Leu Lys  Leu Glu Asp Phe Ile  Pro Met Asp Ser Thr  Val Lys Asn
         2315                    2320                    2325


Tyr Phe  Ile Thr Asp Ala Gln  Thr Gly Ser Ser Lys  Cys Val Cys
         2330                    2335                    2340


Ser Val  Ile Asp Leu Leu Leu  Asp Asp Phe Val Glu  Ile Ile Lys
         2345                    2350                    2355

                                 50
```

Ser Gln Asp Leu Ser Val Ile Ser Lys Val Val Lys Val Thr Ile
    2360   2365   2370

Asp Tyr Ala Glu Ile Ser Phe Met Leu Trp Cys Lys Asp Gly His
    2375   2380   2385

Val Glu Thr Phe Tyr Pro Lys Leu Gln Ala Ser Gln Ala Trp Gln
    2390   2395   2400

Pro Gly Val Ala Met Pro Asn Leu Tyr Lys Met Gln Arg Met Leu
    2405   2410   2415

Leu Glu Lys Cys Asp Leu Gln Asn Tyr Gly Glu Asn Ala Val Ile
    2420   2425   2430

Pro Lys Gly Ile Met Met Asn Val Ala Lys Tyr Thr Gln Leu Cys
    2435   2440   2445

Gln Tyr Leu Asn Thr Leu Thr Leu Ala Val Pro Tyr Asn Met Arg
    2450   2455   2460

Val Ile His Phe Gly Ala Gly Ser Asp Lys Gly Val Ala Pro Gly
    2465   2470   2475

Thr Ala Val Leu Arg Gln Trp Leu Pro Thr Gly Thr Leu Leu Val
    2480   2485   2490

Asp Ser Asp Leu Asn Asp Phe Val Ser Asp Ala Asp Ser Thr Leu
    2495   2500   2505

Ile Gly Asp Cys Ala Thr Val His Thr Ala Asn Lys Trp Asp Leu
    2510   2515   2520

Ile Ile Ser Asp Met Tyr Asp Pro Arg Thr Lys His Val Thr Lys
    2525   2530   2535

Glu Asn Asp Ser Lys Glu Gly Phe Phe Thr Tyr Leu Cys Gly Phe
    2540   2545   2550

Ile Lys Gln Lys Leu Ala Leu Gly Gly Ser Ile Ala Val Lys Ile
    2555   2560   2565

51

Thr Glu His Ser Trp Asn Ala Asp Leu Tyr Lys Leu Met Gly His
    2570   2575   2580

Phe Ser Trp Trp Thr Ala Phe Val Thr Asn Val Asn Ala Ser Ser
    2585   2590   2595

Ser Glu Ala Phe Leu Ile Gly Ala Asn Tyr Leu Gly Lys Pro Lys
    2600   2605   2610

Glu Gln Ile Asp Gly Tyr Thr Met His Ala Asn Tyr Ile Phe Trp
    2615   2620   2625

Arg Asn Thr Asn Pro Ile Gln Leu Ser Ser Tyr Ser Leu Phe Asp
    2630   2635   2640

Met Ser Lys Phe Pro Leu Lys Leu Arg Gly Thr Ala Val Met Ser
    2645   2650   2655

Leu Lys Glu Asn Gln Ile Asn Asp Met Ile Tyr Ser Leu Leu Glu
    2660   2665   2670

Lys Gly Arg Leu Ile Ile Arg Glu Asn Asn Arg Val Val Val Ser
    2675   2680   2685

Ser Asp Ile Leu Val Asn Asn
    2690   2695

<210> 4
<211> 1255
<212> PRT
<213> Coronavirus

<400> 4

Met Phe Ile Phe Leu Leu Phe Leu Thr Leu Thr Ser Gly Ser Asp Leu
1   5   10   15

Asp Arg Cys Thr Thr Phe Asp Asp Val Gln Ala Pro Asn Tyr Thr Gln
        20   25   30

His Thr Ser Ser Met Arg Gly Val Tyr Tyr Pro Asp Glu Ile Phe Arg
        35   40   45

Ser Asp Thr Leu Tyr Leu Thr Gln Asp Leu Phe Leu Pro Phe Tyr Ser
    50   55   60

52

```
Asn Val Thr Gly Phe His Thr Ile Asn His Thr Phe Gly Asn Pro Val
65              70              75              80


Ile Pro Phe Lys Asp Gly Ile Tyr Phe Ala Ala Thr Glu Lys Ser Asn
                85              90              95


Val Val Arg Gly Trp Val Phe Gly Ser Thr Met Asn Asn Lys Ser Gln
            100             105             110


Ser Val Ile Ile Ile Asn Asn Ser Thr Asn Val Val Ile Arg Ala Cys
            115             120             125


Asn Phe Glu Leu Cys Asp Asn Pro Phe Phe Ala Val Ser Lys Pro Met
    130             135             140


Gly Thr Gln Thr His Thr Met Ile Phe Asp Asn Ala Phe Asn Cys Thr
145             150             155             160


Phe Glu Tyr Ile Ser Asp Ala Phe Ser Leu Asp Val Ser Glu Lys Ser
            165             170             175


Gly Asn Phe Lys His Leu Arg Glu Phe Val Phe Lys Asn Lys Asp Gly
            180             185             190


Phe Leu Tyr Val Tyr Lys Gly Tyr Gln Pro Ile Asp Val Val Arg Asp
        195             200             205


Leu Pro Ser Gly Phe Asn Thr Leu Lys Pro Ile Phe Lys Leu Pro Leu
    210             215             220


Gly Ile Asn Ile Thr Asn Phe Arg Ala Ile Leu Thr Ala Phe Ser Pro
225             230             235             240


Ala Gln Asp Ile Trp Gly Thr Ser Ala Ala Ala Tyr Phe Val Gly Tyr
            245             250             255


Leu Lys Pro Thr Thr Phe Met Leu Lys Tyr Asp Glu Asn Gly Thr Ile
            260             265             270


Thr Asp Ala Val Asp Cys Ser Gln Asn Pro Leu Ala Glu Leu Lys Cys
        275             280             285
```

```
Ser Val Lys Ser Phe Glu Ile Asp Lys Gly Ile Tyr Gln Thr Ser Asn
    290             295             300

Phe Arg Val Val Pro Ser Gly Asp Val Val Arg Phe Pro Asn Ile Thr
305             310             315             320

Asn Leu Cys Pro Phe Gly Glu Val Phe Asn Ala Thr Lys Phe Pro Ser
            325             330             335

Val Tyr Ala Trp Glu Arg Lys Lys Ile Ser Asn Cys Val Ala Asp Tyr
            340             345             350

Ser Val Leu Tyr Asn Ser Thr Phe Phe Ser Thr Phe Lys Cys Tyr Gly
            355             360             365

Val Ser Ala Thr Lys Leu Asn Asp Leu Cys Phe Ser Asn Val Tyr Ala
    370             375             380

Asp Ser Phe Val Val Lys Gly Asp Asp Val Arg Gln Ile Ala Pro Gly
385             390             395             400

Gln Thr Gly Val Ile Ala Asp Tyr Asn Tyr Lys Leu Pro Asp Asp Phe
            405             410             415

Met Gly Cys Val Leu Ala Trp Asn Thr Arg Asn Ile Asp Ala Thr Ser
            420             425             430

Thr Gly Asn Tyr Asn Tyr Lys Tyr Arg Tyr Leu Arg His Gly Lys Leu
            435             440             445

Arg Pro Phe Glu Arg Asp Ile Ser Asn Val Pro Phe Ser Pro Asp Gly
    450             455             460

Lys Pro Cys Thr Pro Pro Ala Leu Asn Cys Tyr Trp Pro Leu Asn Asp
465             470             475             480

Tyr Gly Phe Tyr Thr Thr Thr Gly Ile Gly Tyr Gln Pro Tyr Arg Val
            485             490             495

            .
Val Val Leu Ser Phe Glu Leu Leu Asn Ala Pro Ala Thr Val Cys Gly
            500             505             510
```

54

```
Pro Lys Leu Ser Thr Asp Leu Ile Lys Asn Gln Cys Val Asn Phe Asn
        515                 520             525

Phe Asn Gly Leu Thr Gly Thr Gly Val Leu Thr Pro Ser Ser Lys Arg
        530             535             540

Phe Gln Pro Phe Gln Gln Phe Gly Arg Asp Val Ser Asp Phe Thr Asp
545                     550             555                 560

Ser Val Arg Asp Pro Lys Thr Ser Glu Ile Leu Asp Ile Ser Pro Cys
            565                 570             575

Ser Phe Gly Gly Val Ser Val Ile Thr Pro Gly Thr Asn Ala Ser Ser
            580             585             590

Glu Val Ala Val Leu Tyr Gln Asp Val Asn Cys Thr Asp Val Ser Thr
        595             600             605

Ala Ile His Ala Asp Gln Leu Thr Pro Ala Trp Arg Ile Tyr Ser Thr
        610             615             620

Gly Asn Asn Val Phe Gln Thr Gln Ala Gly Cys Leu Ile Gly Ala Glu
625                 630             635                     640

His Val Asp Thr Ser Tyr Glu Cys Asp Ile Pro Ile Gly Ala Gly Ile
                645             650             655

Cys Ala Ser Tyr His Thr Val Ser Leu Leu Arg Ser Thr Ser Gln Lys
            660             665             670

Ser Ile Val Ala Tyr Thr Met Ser Leu Gly Ala Asp Ser Ser Ile Ala
            675             680             685

Tyr Ser Asn Asn Thr Ile Ala Ile Pro Thr Asn Phe Ser Ile Ser Ile
        690             695             700

Thr Thr Glu Val Met Pro Val Ser Met Ala Lys Thr Ser Val Asp Cys
705             710             715                 720

Asn Met Tyr Ile Cys Gly Asp Ser Thr Glu Cys Ala Asn Leu Leu Leu
            725             730             735

Gln Tyr Gly Ser Phe Cys Thr Gln Leu Asn Arg Ala Leu Ser Gly Ile
```

55

Ala Ala Glu Gln Asp Arg Asn Thr Arg Glu Val Phe Ala Gln Val Lys
        755   760   765

Gln Met Tyr Lys Thr Pro Thr Leu Lys Tyr Phe Gly Gly Phe Asn Phe
        770   775   780

Ser Gln Ile Leu Pro Asp Pro Leu Lys Pro Thr Lys Arg Ser Phe Ile
785   790   795   800

Glu Asp Leu Leu Phe Asn Lys Val Thr Leu Ala Asp Ala Gly Phe Met
                405   810   815

Lys Gln Tyr Gly Glu Cys Leu Gly Asp Ile Asn Ala Arg Asp Leu Ile
            820   825   830

Cys Ala Gln Lys Phe Asn Gly Leu Thr Val Leu Pro Pro Leu Leu Thr
        835   840   845

Asp Asp Met Ile Ala Ala Tyr Thr Ala Ala Leu Val Ser Gly Thr Ala
    850   855   860

Thr Ala Gly Trp Thr Phe Gly Ala Gly Ala Ala Leu Gln Ile Pro Phe
865   870   875   880

Ala Met Gln Met Ala Tyr Arg Phe Asn Gly Ile Gly Val Thr Gln Asn
                885   890   895

Val Leu Tyr Glu Asn Gln Lys Gln Ile Ala Asn Gln Phe Asn Lys Ala
            900   905   910

Ile Ser Gln Ile Gln Glu Ser Leu Thr Thr Thr Ser Thr Ala Leu Gly
            915   920   925

Lys Leu Gln Asp Val Val Asn Gln Asn Ala Gln Ala Leu Asn Thr Leu
    930   935   940

Val Lys Gln Leu Ser Ser Asn Phe Gly Ala Ile Ser Ser Val Leu Asn
945   950   955   960

Asp Ile Leu Ser Arg Leu Asp Lys Val Glu Ala Glu Val Gln Ile Asp
            965   970   975

Arg Leu Ile Thr Gly Arg Leu Gln Ser Leu Gln Thr Tyr Val Thr Gln
        980   985   990

Gln Leu Ile Arg Ala Ala Glu Ile Arg Ala Ser Ala Asn Leu Ala Ala
        995   1000   1005

Thr Lys Met Ser Glu Cys Val Leu Gly Gln Ser Lys Arg Val Asp
    1010   1015   1020

Phe Cys Gly Lys Gly Tyr His Leu Met Ser Phe Pro Gln Ala Ala
    1025   1030   1035

Pro His Gly Val Val Phe Leu His Val Thr Tyr Val Pro Ser Gln
    1040   1045   1050

Glu Arg Asn Phe Thr Thr Ala Pro Ala Ile Cys His Glu Gly Lys
    1055   1060   1065

Ala Tyr Phe Pro Arg Glu Gly Val Phe Val Phe Asn Gly Thr Ser
    1070   1075   1080

Trp Phe Ile Thr Gln Arg Asn Phe Phe Ser Pro Gln Ile Ile Thr
    1085   1090   1095

Thr Asp Asn Thr Phe Val Ser Gly Asn Cys Asp Val Val Ile Gly
    1100   1105   1110

Ile Ile Asn Asn Thr Val Tyr Asp Pro Leu Gln Pro Glu Leu Asp
    1115   1120   1125

Ser Phe Lys Glu Glu Leu Asp Lys Tyr Phe Lys Asn His Thr Ser
    1130   1135   1140

Pro Asp Val Asp Leu Gly Asp Ile Ser Gly Ile Asn Ala Ser Val
    1145   1150   1155

Val Asn Ile Gln Lys Glu Ile Asp Arg Leu Asn Glu Val Ala Lys
    1160   1165   1170

Asn Leu Asn Glu Ser Leu Ile Asp Leu Gln Glu Leu Gly Lys Tyr
    1175   1180   1185

57

Glu Gln Tyr Ile Lys Trp Pro Trp Tyr Val Trp Leu Gly Phe Ile
    1190   1195   1200

Ala Gly Leu Ile Ala Ile Val Met Val Thr Ile Leu Leu Cys Cys
    1205   1210   1215

Met Thr Ser Cys Cys Ser Cys Leu Lys Gly Ala Cys Ser Cys Gly
    1220   1225   1230

Ser Cys Cys Lys Phe Asp Glu Asp Asp Ser Glu Pro Val Leu Lys
    1235   1240   1245

Gly Val Lys Leu His Tyr Thr
    1250   1255

<210> 5
<211> 274
<212> PRT
<213> Coronavirus

<400> 5

Met Asp Leu Phe Met Arg Phe Phe Thr Leu Gly Ser Ile Thr Ala Gln
1   5   10   15

Pro Val Lys Ile Asp Asn Ala Ser Pro Ala Ser Thr Val His Ala Thr
            20   25   30

Ala Thr Ile Pro Leu Gln Ala Ser Leu Pro Phe Gly Trp Leu Val Ile
            35   40   45

Gly Val Ala Phe Leu Ala Val Phe Gln Ser Ala Thr Lys Ile Ile Ala
    50   55   60

Leu Asn Lys Arg Trp Gln Leu Ala Leu Tyr Lys Gly Phe Gln Phe Ile
65   70   75   80

Cys Asn Leu Leu Leu Leu Phe Val Thr Ile Tyr Ser His Leu Leu Leu
            85   90   95

Val Ala Ala Gly Met Glu Ala Gln Phe Leu Tyr Leu Tyr Ala Leu Ile
            100   105   110

Tyr Phe Leu Gln Cys Ile Asn Ala Cys Arg Ile Ile Met Arg Cys Trp

Leu Cys Trp Lys Cys Lys Ser Lys Asn Pro Leu Leu Tyr Asp Ala Asn
    130   135   140

Tyr Phe Val Cys Trp His Thr His Asn Tyr Asp Tyr Cys Ile Pro Tyr
145   150   155   160

Asn Ser Val Thr Asp Thr Ile Val Val Thr Glu Gly Asp Gly Ile Ser
                165   170   175

Thr Pro Lys Leu Lys Glu Asp Tyr Gln Ile Gly Gly Tyr Ser Glu Asp
                180   185   190

Arg His Ser Gly Val Lys Asp Tyr Val Val Val His Gly Tyr Phe Thr
            195   200   205

Glu Val Tyr Tyr Gln Leu Glu Ser Thr Gln Ile Thr Thr Asp Thr Gly
    210   215   220

Ile Glu Asn Ala Thr Phe Phe Ile Phe Asn Lys Leu Val Lys Asp Pro
225   230   235   240

Pro Asn Val Gln Ile His Thr Ile Asp Gly Ser Ser Gly Val Ala Asn
                245   250   255

Pro Ala Met Asp Pro Ile Tyr Asp Glu Pro Thr Thr Thr Thr Ser Val
            260   265   270

Pro Leu

<210> 6
<211> 154
<212> PRT
<213> Coronavirus

<400> 6

Met Met Pro Thr Thr Leu Phe Ala Gly Thr His Ile Thr Met Thr Thr
1   5   10   15

Val Tyr His Ile Thr Val Ser Gln Ile Gln Leu Ser Leu Leu Lys Val
                20   25   30

Thr Ala Phe Gln His Gln Asn Ser Lys Lys Thr Thr Lys Leu Val Val
        35   40   45

Ile Leu Arg Ile Gly Thr Gln Val Leu Lys Thr Met Ser Leu Tyr Met
    50   55   60

Ala Ile Ser Pro Lys Phe Thr Thr Ser Leu Ser Leu His Lys Leu Leu
65   70   75   80

Gln Thr Leu Val Leu Lys Met Leu His Ser Ser Ser Leu Thr Ser Leu
            85   90   95

Leu Lys Thr His Arg Met Cys Lys Tyr Thr Gln Ser Thr Ala Leu Gln
            100   105   110

Glu Leu Leu Ile Gln Gln Trp Ile Gln Phe Met Met Ser Arg Arg Arg
        115   120   125

Leu Leu Ala Cys Leu Cys Lys His Lys Lys Val Ser Thr Asn Leu Cys
    130   135   140

Thr His Ser Phe Arg Lys Lys Gln Val Arg
145   150

<210>   7
<211>   76
<212>   PRT
<213>   Coronavirus

<400>   7

Met Tyr Ser Phe Val Ser Glu Glu Thr Gly Thr Leu Ile Val Asn Ser
1   5   10   15

Val Leu Leu Phe Leu Ala Phe Val Val Phe Leu Leu Val Thr Leu Ala
            20   25   30

Ile Leu Thr Ala Leu Arg Leu Cys Ala Tyr Cys Cys Asn Ile Val Asn
        35   40   45

Val Ser Leu Val Lys Pro Thr Val Tyr Val Tyr Ser Arg Val Lys Asn
    50   55   60

Leu Asn Ser Ser Glu Gly Val Pro Asp Leu Leu Val

60

<210> 8
<211> 221
<212> PRT
<213> Coronavirus

<400> 8

Met Ala Asp Asn Gly Thr Ile Thr Val Glu Glu Leu Lys Gln Leu Leu
1   5   10   15

Glu Gln Trp Asn Leu Val Ile Gly Phe Leu Phe Leu Ala Trp Ile Met
            20   25   30

Leu Leu Gln Phe Ala Tyr Ser Asn Arg Asn Arg Phe Leu Tyr Ile Ile
            35   40   45

Lys Leu Val Phe Leu Trp Leu Leu Trp Pro Val Thr Leu Ala Cys Phe
    50   55   60

Val Leu Ala Ala Val Tyr Arg Ile Asn Trp Val Thr Gly Gly Ile Ala
65   70   75   80

Ile Ala Met Ala Cys Ile Val Gly Leu Met Trp Leu Ser Tyr Phe Val
            85   90   95

Ala Ser Phe Arg Leu Phe Ala Arg Thr Arg Ser Met Trp Ser Phe Asn
            100   105   110

Pro Glu Thr Asn Ile Leu Leu Asn Val Pro Leu Arg Gly Thr Ile Val
            115   120   125

Thr Arg Pro Leu Met Glu Ser Glu Leu Val Ile Gly Ala Val Ile Ile
    130   135   140

Arg Gly His Leu Arg Met Ala Gly His Pro Leu Gly Arg Cys Asp Ile
145   150   155   160

Lys Asp Leu Pro Lys Glu Ile Thr Val Ala Thr Ser Arg Thr Leu Ser
            165   170   175

Tyr Tyr Lys Leu Gly Ala Ser Gln Arg Val Gly Thr Asp Ser Gly Phe
            180   185   190

Ala Ala Tyr Asn Arg Tyr Arg Ile Gly Asn Tyr Lys Leu Asn Thr Asp
        195   200   205

His Ala Gly Ser Asn Asp Asn Ile Ala Leu Leu Val Gln
    210   215   220

<210> 9
<211> 63
<212> PRT
<213> Coronavirus

<400> 9

Met Phe His Leu Val Asp Phe Gln Val Thr Ile Ala Glu Ile Leu Ile
1   5   10   15

Ile Ile Met Arg Thr Phe Arg Ile Ala Ile Trp Asn Leu Asp Val Ile
            20   25   30

Ile Ser Ser Ile Val Arg Gln Leu Phe Lys Pro Leu Thr Lys Lys Asn
            35   40   45

Tyr Ser Glu Leu Asp Asp Glu Glu Pro Met Glu Leu Asp Tyr Pro
    50   55   60

<210> 10
<211> 122
<212> PRT
<213> Coronavirus

<400> 10

Met Lys Ile Ile Leu Phe Leu Thr Leu Ile Val Phe Thr Ser Cys Glu
1   5   10   15

Leu Tyr His Tyr Gln Glu Cys Val Arg Gly Thr Thr Val Leu Leu Lys
            20   25   30

Glu Pro Cys Pro Ser Gly Thr Tyr Glu Gly Asn Ser Pro Phe His Pro
            35   40   45

Leu Ala Asp Asn Lys Phe Ala Leu Thr Cys Thr Ser Thr His Phe Ala
    50   55   60

Phe Ala Cys Ala Asp Gly Thr Arg His Thr Tyr Gln Leu Arg Ala Arg
65   70   75   80

Ser Val Ser Pro Lys Leu Phe Ile Arg Gln Glu Glu Val Gln Gln Glu
            85   90   95

Leu Tyr Ser Pro Leu Phe Leu Ile Val Ala Ala Leu Val Phe Leu Ile
            100   105   110

Leu Cys Phe Thr Ile Lys Arg Lys Thr Glu
            115   120

<210> 11
<211> 84
<212> PRT
<213> Coronavirus

<400> 11

Met Cys Leu Lys Ile Leu Val Arg Tyr Asn Thr Arg Gly Asn Thr Tyr
1   5   10   15

Ser Thr Ala Trp Leu Cys Ala Leu Gly Lys Val Leu Pro Phe His Arg
            20   25   30

Trp His Thr Met Val Gln Thr Cys Thr Pro Asn Val Thr Ile Asn Cys
            35   40   45

Gln Asp Pro Ala Gly Gly Ala Leu Ile Ala Arg Cys Trp Tyr Leu His
    50   55   60

Glu Gly His Gln Thr Ala Ala Phe Arg Asp Val Leu Val Val Leu Asn
65   70   75   80

Lys Arg Thr Asn

<210> 12
<211> 422
<212> PRT
<213> Coronavirus

<400> 12

Met Ser Asp Asn Gly Pro Gln Ser Asn Gln Arg Ser Ala Pro Arg Ile
1   5   10   15

Thr Phe Gly Gly Pro Thr Asp Ser Thr Asp Asn Asn Gln Asn Gly Gly
            20   25   30

```
Arg Asn Gly Ala Arg Pro Lys Gln Arg Arg Pro Gln Gly Leu Pro Asn
        35                  40              45

Asn Thr Ala Ser Trp Phe Thr Ala Leu Thr Gln His Gly Lys Glu Glu
        50              55              60

Leu Arg Phe Pro Arg Gly Gln Gly Val Pro Ile Asn Thr Asn Ser Gly
65                  70              75                  80

Pro Asp Asp Gln Ile Gly Tyr Tyr Arg Arg Ala Thr Arg Arg Val Arg
                85              90                  95

Gly Gly Asp Gly Lys Met Lys Glu Leu Ser Pro Arg Trp Tyr Phe Tyr
            100             105             110

Tyr Leu Gly Thr Gly Pro Glu Ala Ser Leu Pro Tyr Gly Ala Asn Lys
        115             120             125

Glu Gly Ile Val Trp Val Ala Thr Glu Gly Ala Leu Asn Thr Pro Lys
        130             135             140

Asp His Ile Gly Thr Arg Asn Pro Asn Asn Asn Ala Ala Thr Val Leu
145                 150             155                 160

Gln Leu Pro Gln Gly Thr Thr Leu Pro Lys Gly Phe Tyr Ala Glu Gly
            165             170             175

Ser Arg Gly Gly Ser Gln Ala Ser Ser Arg Ser Ser Ser Arg Ser Arg
            180             185             190

Gly Asn Ser Arg Asn Ser Thr Pro Gly Ser Ser Arg Gly Asn Ser Pro
            195             200             205

Ala Arg Met Ala Ser Gly Gly Gly Glu Thr Ala Leu Ala Leu Leu Leu
        210             215             220

Leu Asp Arg Leu Asn Gln Leu Glu Ser Lys Val Ser Gly Lys Gly Gln
225                 230             235                 240

Gln Gln Gln Gly Gln Thr Val Thr Lys Lys Ser Ala Ala Glu Ala Ser
            245             250             255

Lys Lys Pro Arg Gln Lys Arg Thr Ala Thr Lys Gln Tyr Asn Val Thr
                            64
```

Gln Ala Phe Gly Arg Arg Gly Pro Glu Gln Thr Gln Gly Asn Phe Gly
        275   280   285

Asp Gln Asp Leu Ile Arg Gln Gly Thr Asp Tyr Lys His Trp Pro Gln
        290   295   300

Ile Ala Gln Phe Ala Pro Ser Ala Ser Ala Phe Phe Gly Met Ser Arg
305   310   315   320

Ile Gly Met Glu Val Thr Pro Ser Gly Thr Trp Leu Thr Tyr His Gly
            325   330   335

Ala Ile Lys Leu Asp Asp Lys Asp Pro Gln Phe Lys Asp Asn Val Ile
        340   345   350

Leu Leu Asn Lys His Ile Asp Ala Tyr Lys Thr Phe Pro Pro Thr Glu
        355   360   365

Pro Lys Lys Asp Lys Lys Lys Lys Thr Asp Glu Ala Gln Pro Leu Pro
        370   375   380

Gln Arg Gln Lys Lys Gln Pro Thr Val Thr Leu Leu Pro Ala Ala Asp
385   390   395   400

Met Asp Asp Phe Ser Arg Gln Leu Gln Asn Ser Met Ser Gly Ala Ser
                405   410   415

Ala Asp Ser Thr Gln Ala
            420

<210> 13
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 13
ctaacatgct taggataatg g   21

<210> 14
<211> 21

```
<212>  DNA
<213>  Artificial Sequence

<220>
<223>  Synthetic oligonucleotide.

<400>  14
gcctctcttg ttcttgctcg c                                        21


<210>  15
<211>  21
<212>  DNA
<213>  Artificial Sequence

<220>
<223>  Synthetic oligonucleotide.

<400>  15
caggtaagcg taaaactcat c                                        21


<210>  16
<211>  22
<212>  DNA
<213>  Artificial Sequence

<220>
<223>  Synthetic oligonucleotide.

<400>  16
catgtgtggc ggctcactat at                                       22


<210>  17
<211>  28
<212>  DNA
<213>  Artificial Sequence

<220>
<223>  Synthetic oligonucleotide.

<400>  17
gacactatta gcataagcag ttgtagca                                 28


<210>  18
<211>  27
<212>  DNA
<213>  Artificial Sequence

<220>
<223>  Synthetic oligonucleotide.

<400>  18
ttaaaccagg tggaacatca tccggtg                                  27
```

<210> 19
<211> 22
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 19
ggagccttga atacacccaa ag   22

<210> 20
<211> 17
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 20
gcacggtggc agcattg   17

<210> 21
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 21
ccacattggc acccgcaatc c   21

<210> 22
<211> 19
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 22
caaacattgg ccgcaaatt   19

<210> 23
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 23

caatgcgtga cattccaaag a   21

<210> 24
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 24
cacaatttgc tccaagtgcc tctgca   26

<210> 25
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 25
gaagtaccat ctggggctga g   21

<210> 26
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 26
ccgaagagct acccgacg   18

<210> 27
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 27
ctctttcatt ttgccgtcac caccac   26

<210> 28
<211> 24
<212> DNA
<213> Artificial Sequence

<220>

<223> Synthetic oligonucleotide.

<400> 28
agctctccct agcattattc actg   24

<210> 29
<211> 20
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 29
caccacattt tcatcgaggc   20

<210> 30
<211> 22
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 30
taccctcgat cgtactccgc gt   22

<210> 31
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 31
tgtaggcact gattcaggtt ttg   23

<210> 32
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 32
cggcgtggtc tgtatttaat tta   23

<210> 33
<211> 27
<212> DNA

<210> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 33
ctgcatacaa ccgctaccgt attggaa   27

<210> 34
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 34
gggttgggac tatcctaagt gtga   24

<210> 35
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<220>
<221> misc_feature
<222> (12)..(12)
<223> "n" equals inosine.

<400> 35
taacacacaa cnccatcatc a   21

<210> 36
<211> 19
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 36
agatttggac ctgcgagcg   19

<210> 37
<211> 20
<212> DNA
<213> Artificial Sequence

<220>

<223> Synthetic oligonucleotide.

<400> 37
gagcggctgt ctccacaagt   20

<210> 38
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic oligonucleotide.

<400> 38
ttctgacctg aaggctctgc gcg   23